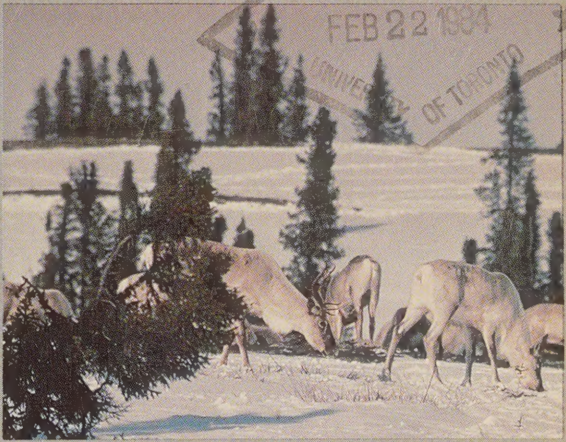
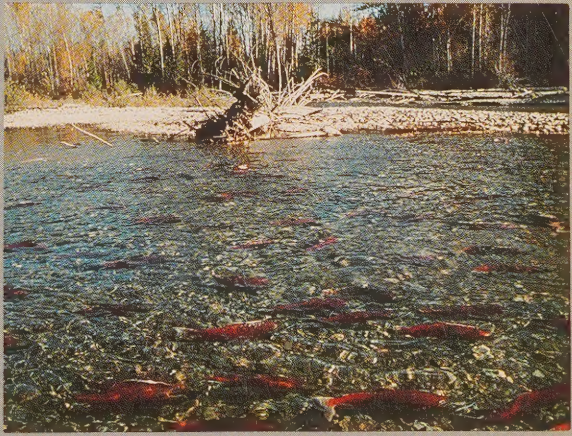
LAND/WILDLIFE INTEGRATION NO. 2

INTÉGRATION TERRE/FAUNE N° 2





Ecological Land Classification Series, No. 17

Série de la classification écologique du territoire, N° 17

LAND/WILDLIFE INTEGRATION NO. 2

INTÉGRATION TERRE/ FAUNE N° 2

Proceedings of a technical workshop to discuss the incorporation of wildlife information into ecological land surveys

21-24 March 1982
Banff, Alberta

Compte rendu d'un atelier technique sur l'introduction de l'information sur la faune dans les relevés écologiques du territoire

21-24 mars 1982
Banff, Alberta

Compiled by
H.A. Stelfox and G.R. Ironside

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Lands Directorate
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Direction générale des terres
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PREFACE

The Canada Committee on Ecological Land Classification (CCELC) was formed in 1976 and its stated goal is to encourage the development and application of a uniform ecological approach to land classification. This Committee has a permanent Secretariat which is staffed and funded by the Lands Directorate of Environment Canada. Within this Committee several working groups have been formed to pursue specific objectives related to the exchange of technical information and the development of methodologies on subjects such as land/water integration, wetlands classification and vegetation classification.

The incorporation of faunal attributes into ecological land surveys (ELS) is particularly difficult because animal populations may be very inconspicuous or transitory and their numbers can fluctuate widely over time for a variety of reasons. Land/Wildlife Integration Workshop #1, which was organized by the CCELC and held in Saskatoon in May 1979, helped to bring into focus some of these difficulties. As a result of this Workshop a Wildlife Working Group (WWG) of the CCELC was formed in October 1980. The stated goal of the Working Group is "to encourage and facilitate the development of effective and standardized methodologies for wildlife habitat classification and evaluation, as well as to further the integration of wildlife values within an ecological land survey framework". (It should be noted that the term 'wildlife' is used in its broadest sense to encompass all non-domesticated animal life.) The WWG is pursuing its goal through: the establishment of a voluntary membership which embodies relevant expertise; the exchange of technical information through correspondence, newsletters and workshops; and the preparation of written documents that provide methodology guidelines and concepts, including the identification of useful terms, definitions and reference materials.

This meeting, Land/Wildlife Integration Workshop #2, is a part of the overall process in meeting the WWG's goals. The particular objectives for this Workshop are identified as follows:

1. To define and document, with the aid of historical perspectives, what wildlife habitat inventories are, why we do them (what their uses are), and what their deficiencies have been in the past.

PRÉFACE

Le Comité canadien de la classification écologique du territoire (CCCET) a été constitué en 1976 dans le but de favoriser l'établissement et l'application d'une approche écologique uniforme dans la classification du territoire. Le Comité a un secrétariat permanent dont les ressources humaines et financières sont assurées par la Direction générale des terres d'Environnement Canada. Le Comité a formé plusieurs groupes de travail qui poursuivent des objectifs précis touchant les échanges d'information technique et l'établissement de méthodes dans des domaines comme: l'intégration terre-eau, la classification des terres humides et la classification de la végétation.

L'intégration de la faune aux relevés écologiques du territoire rend la tâche particulièrement difficile du fait que les populations animales sont mobiles et furtives et que leurs nombres fluctuent avec le temps pour différentes raisons. L'atelier n° 1, <u>Intégration terre/faune</u>, organisé par le CCCET et tenu à Saskatoon en mai 1979, a permis de mettre en lumière certaines de ces difficultés. Suite à cet atelier, un groupe de travail sur la faune a été constitué en octobre 1980 en vue de favoriser et faciliter la mise en oeuvre de méthodes uniformes de classification et d'évaluation des habitats fauniques ainsi qu'une intégration plus rigoureuse des valeurs fauniques ainsi aux relevés écologiques du territoire. (À remarquer que les termes <u>faune</u> et <u>faunique</u> sont employés dans leur acception la plus étendue, c'est-à-dire qu'ils désignent l'ensemble de la vie animale "non domestiquée"). Dans le but de réaliser son objectif, le Groupe de travail sur la faune a décidé: que ces membres seraient constitués de volontaires spécialisés dans les domaines voulus; qu'ils procéderaient à des échanges d'information technique au moyen de correspondance, de bulletins et d'ateliers; qu'ils rédigeraient des documents qui présenteraient des lignes directrices et des notions fondamentales, dont des termes utiles, des définitions et de la documentation.

La rencontre, <u>Atelier N° 2 sur l'intégration terre/faune</u> entrait dans le cadre des activités qui permettent au Groupe de travail sur la faune d'atteindre ses objectifs. Les buts de cet atelier étaient les suivants:

1. Définir et appuyer par la documentation, dans une perspective historique, ce que sont les inventaires d'habitats fauniques,

2. To identify the advantages and disadvantages of pursuing an integrated (ecological) approach to habitat inventory, including identification of appropriate and inappropriate integration methodologies and product formats.

3. To present and document the methodologies and results of various fish and wildlife habitat inventories conducted throughout Canada.

4. To initiate the process of developing standardized guidelines for conducting habitat inventory as required for various applications.

5. To clarify the future organization, objectives and priority activities of the Wildlife Working Group.

Underlying all of these discussions and recommendations is a concern for relevancy. As a group of individuals primarily involved with the collection, analysis and presentation of natural resource information we must be particularly sensitive to the needs of our clients. We have to provide information of the type and in the format that most readily meets the requirements of our resource planners and managers, so as to enable them to make good decisions on the issues they face in the interest of sound land management.

H.A. Stelfox
Chairman
Wildlife Working Group

pourquoi nous les faisons (leur utilité), et quelles ont été les lacunes dans le passé.

2. Trouver les avantages et les désavantages de l'approche (écologique) globale dans les inventaires d'habitats, y compris la détermination des méthodes d'intégration appropriées et inappropriées et des produits valables et non valables.

3. Présenter et documenter les méthodes et les résultats des inventaires d'habitats des poissons et de la faune au Canada.

4. Amorcer le processus d'étbalissement de lignes directrices uniformes pour les inventaires d'habitats, selon les buts poursuivis.

5. Clarifier la structure organisationnelle, les objectifs et les activités prioritaires du Groupe de travail sur la faune.

Le désir de jouer un rôle utile soustend toutes les discussions et recommandations. Comme groupe de personnes dont le travail consiste avant tout à recueillir, analyser et présenter de l'information sur les ressources naturelles, il faut être très attentif aux besoins de notre clientèle. Il faut présenter ce genre d'information dans une forme qui satisfasse aux exigences des planificateurs et des gestionnaires des ressources, pour les aider à prendre des décisions judicieuses sur les questions à résoudre et parvenir ainsi à une saine gestion du territoire.

H.A. Stelfox
Président
Groupe de travail sur la faune

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2. Woodland caribou in taiga, Lake Bienville area, Quebec; J.-L. Frund, April 1977.

3. Adult snow goose and gosling on arctic tundra plain, Bylot Island, N.W.T.; J.-L. Frund, 1975.

4. Spawning sockeye salmon in Adam's River, B.C.; R.S. Rodvick, 1979.

5. Aerial view of the Yukon River between Dawson City and Clinton Creek, Yukon Territory; G. Hunter, 1973.

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BACKGROUND PAPERS

ÉTUDES DE FOND

WORKSHOP INTRODUCTION AND WELCOME

D. J. Neave
Fish and Wildlife Division
Alberta Energy and Natural Resources
Edmonton, Alberta

On behalf of Dennis Surrendi, Alberta's new Assistant Deputy Minister and myself I would like to welcome you to this workshop, and to Alberta if you are from out of province. The Fish and Wildlife Division and others within the Department of Energy & Natural Resources are very interested in the work of this Committee, which I understand, and as your Chairman just stated, is to both develop an effective and standardized methodology and to further the integration of fish and wildlife values within an ecological framework.

Our Division is just going through a very frustrating exercise in looking at the various fish and wildlife inventory programs. I am sure most agencies have many of the same problems that we identified; inventories were done for single species, data is unorganized and is not easily retrievable. Historically inventories have had a single objective and the information is ineffective for resource planning exercises and land/water planning programs that are so necessary in the 80's. A Divisional inventory task force is proposing a Provincial inventory system to cover fish and wildlife species and their habitats, to provide a comprehensive data storage and retrieval system and to use an ecological land unit basis as a framework. We are very optimistic that this program will get off the ground, not necessarily because of our own salesmanship but because we are criticized so much within the Department and by industry for our lack of good inventory information. We are also optimistic that after the Departmental $15,000,000.00 Phase 3 Forest Inventory Program is completed, emphasis and dollars will be transferred into a Fish and Wildlife Habitat Inventory. Lastly, we are keen and enthusiastic as the Department is committed to both a computer graphic mapping system which is supposed to be on line this year and also a land status automated system. Both are steps towards a possible future Natural Resources Data Bank for the Department.

So, all in all, the onus is on the Division to become organized and develop a provincial habitat inventory program. We can certainly benefit from your workshop recommendations on methodology.

Reflecting on the past, we have a couple of old time biologists that have created nothing but heartburn to administrators, other agencies and industry. One of these individuals was the first to promote critical wildlife area designations in the province. He pushed the conditions that we used to protect those areas on various types of applications and as some of you know the critical wildlife areas became Zone 2's, the infamous Zone 2's of Alberta's East Slopes Policy. However, to more effectively input wildlife values into the integrated management planning process he is now tying wildlife values to ecological land classifications for his submissions in our current land planning exercises. This has a much more solid basis of justification to land planners and other agencies and I think the approach is so sound that other people are becoming similarly convinced of this approach. I believe the moral of the story is biologists' ability to respond to change; in this case it is emphasis on integrated land planning by changing the single use designation of wildlife or timber, and adopting a more basic approach using an ecological (bio-physical) classification system. The same common basis is being tried in the Grande Prairie area, the Deep Basin oil and gas field with the objective to try and minimize erosion and assist in watershed protection.

My ramblings are just to illustrate that we do believe in the value of a common methodology and the use of an ecological classification system. Your efforts are important to us and I would like to throw out a challenge to you and a statement or two of concern. Unfortunately when we get into a new field we keep re-examining the value of our own efforts. The story of Canadians having a trait of always pulling

themselves up by their roots to make sure they are still growing is often too true. I hope that you avoid that trait. Other people will appraise your results. I understand that your job and your challenge really is to provide clear and precise direction to agencies such as ourselves, what is required and how it should be done. Don't be bashful about showing the economic values, costs and benefits and try to present a full program similar perhaps to what other agencies are so successful in doing. We as biologists tend to be reluctant to clearly state what is required.

Another point of concern is warranted, however, regarding communication. Harry has done a great job for us within the Fish and Wildlife Division in educating other staff, administrators and politicians as to why we require an ecological land classification system. Resist the trap of waiting 5 years, doing your own work and expecting other people to perhaps read journals and reports. You require a commitment and an enthusiasm which has to be rubbed off on many other people around you.

Just as a last comment, I think everybody accepts that habitat is the key to the future of fish and wildlife resources. Habitat inventory is a logical first step in a habitat program followed by planning, protection and development. If you look at the normal sequence that happens within Fish and Wildlife agencies you see that habitat development is the first visible program because it is a positive program and has a high profile. The protection elements come along afterwards and they take most of your time. Then, more recently, we see agencies, including ourselves getting involved in habitat and land planning. Suddenly people are saying habitat inventory is not only required but is mandatory. There is an old cliché that your time has come. I really think it has, and the next five or ten years is going to be the real story on habitat inventory programs in Canada.

Again, I would just like to wish you all the best, say once again that we look forward to seeing what recommendations develop from your workshop over the next four years and the best of luck to you.

ATELIER — INTRODUCTION ET MOT DE BIENVENUE

D. J. Neave
Division des ressources fauniques
Edmonton (Alberta)

Au nom de Dennis Surrendi, nouveau sous-ministre de notre ministère, et en mon nom personnel, je vous souhaite la bienvenue à cet atelier et en Alberta, si vous êtes d'une autre province. La division des ressources fauniques et d'autres services du ministère de l'Énergie et des Richesses naturelles sont très intéressés par le travail du comité qui, je crois comprendre, et comme vient de le dire votre président, est chargé de mettre au point une méthodologie normalisée efficace et de poursuivre l'intégration des valeurs fauniques, dans un cadre écologique.

La division s'emploie à une tâche très ingrate qui consiste à examiner les divers programmes d'inventaires fauniques. Je suis sûr que la plupart des organismes rencontrent les mêmes problèmes que ceux que nous avons relevés; les inventaires existants ne visent qu'une seule espèce, les données sont mal organisées et difficiles à récupérer. Depuis toujours, les inventaires ont un objectif unique; les informations qu'ils fournissent ne peuvent servir pour la planification des ressources ni pour les programmes de planification des terres et des ressources en eau qui seront tellement nécessaires au cours des années 80. Un groupe d'étude de la division propose la mise sur pied d'un système d'inventaire provincial visant la faune terrestre et aquatique et les habitats, qui comporterait un système complet d'emmagasinage et de récupération de données et qui se fonderait sur des unités de terre déterminées au plan écologique. Nous pensons bien que ce programme fonctionnera, non pas nécessairement grâce à notre capacité de persuasion mais parce que nous faisons l'objet de nombreuses critiques de la part du ministère et de l'industrie, à cause de l'absence de bonnes informations sur les inventaires. Nous croyons également que, lorsque l'étape 3 du programme d'inventaire forestier du ministère sera achevée - au coût de 15 000 000 $ - les efforts et les fonds seront orientés vers un inventaire des habitats fauniques. Enfin, nous sommes heureux et enthousiastes face à l'engagement du ministère concernant la mise sur pied d'un système informatisé de cartographie qui doit devenir opérationnel au cours de l'année et d'un système automatisé sur l'état des terres. Ce sont là deux étapes vers une éventuelle banque de données sur les ressources naturelles pour le ministère.

Donc, en somme, il incombe à la division de s'organiser et de mettre sur pied un programme provincial d'inventaire des habitats. À cet égard, il ne fait aucun doute que nous pouvons bénéficier de vos recommandations concernant la méthodologie.

Si nous regardons vers le passé, nous voyons au ministère quelques vieux routiers de la biologie qui n'ont causé aux administrateurs, à d'autres organismes et à l'industrie que des maux de tête. L'un d'eux a été le premier à promouvoir la désignation d'aires fauniques de première importance dans la province. Il mit de l'avant les conditions que nous posions pour la protection de ces aires à diverses fins; comme certains d'entre vous le savent, les aires fauniques de première importance sont devenues les zones 2, les zones 2 de triste mémoire, fruit de la politique albertaine concernant les versants est. Toutefois, afin d'introduire plus efficacement des valeurs fauniques dans le processus intégré de planification gestionnelle, le biologiste en question lie ces valeurs à la classification écologique du territoire dans ses présentations, dans le cadre de nos travaux actuels de planification des terres. Cette démarche se justifie davantage auprès des planificateurs et d'autres organismes, et je considère qu'elle est tellement sensée qu'elle est en train de gagner la faveur d'autres personnes. Cette situation nous montre la capacité d'adaptation au changement qu'ont les biologistes; dans ce cas particulier, la personne insiste sur la planification intégrée des terres en changeant la désignation unique pour la faune ou les ressources forestières et en adoptant une démarche plus fondamentale basée sur un système de classification écologique (biophysique). On essaie la même formule dans la région de Grande Prairie, dans le champ pétrolifère et gazier de Deep Basin, afin de minimiser l'érosion et de faciliter la protection du bassin hydrographique.

Je vous dis tout cela simplement pour vous montrer que nous croyons vraiment en une méthodologie commune et en l'utilisation d'un système de classification écologique. Vos travaux comptent beaucoup pour nous; j'aimerais vous lancer un défi et vous faire part de quelques-unes de nos préoccupations. Malheureusement, lorsque nous débutons dans un domaine nouveau, nous réévaluons constamment nos efforts. On dit que les Canadiens ne sont pas sûrs d'eux-mêmes, et c'est bien vrai. J'espère que vous ne vous laissez pas aller à cette tendance; vos résultats seront bien reçus par les autres. Je crois comprendre que votre tâche, et le défi que vous devez relever, consiste à fournir une orientation claire et précise à des organismes comme le nôtre, à leur indiquer ce qui doit être fait et comment le faire. N'ayez pas peur de montrer les valeurs économiques, les coûts et les autres avantages de vos activités et essayez de présenter un programme complet dans le genre de ceux que réalisent avec tant de succès d'autres organismes. Nous, biologistes, avons tendance à hésiter à énoncer clairement nos besoins et exigences.

Les communications sont une autre cause de préoccupation. Au sein de la division de la faune, Harry a fait un travail remarquable en sensibilisant d'autres employés, des administrateurs et des hommes politiques aux raisons qui justifient un système de classification écologique du territoire. Ne vous laissez pas prendre au piège, n'attendez pas que d'autres lisent les résultats de vos travaux dans des revues ou des rapports. Il vous faut une détermination et un enthousiasme qui doivent déteindre sur le plus grand nombre de personnes possible autour de vous.

Enfin, je crois que chacun considère que la clef de la conservation des ressources fauniques est la protection des habitats. L'inventaire des habitats est la première étape logique d'un programme organisé comportant ensuite la planification, la protection et la mise en valeur. Si vous regardez les activités des organismes de protection de la faune, vous constatez que la mise en valeur des habitats occupe la première place parce que les programmes de ce domaine sont positifs et très visibles. La protection vient ensuite et accapare la majeure partie du temps. Récemment, on a vu différents organismes, dont le nôtre, s'engager dans la planification des habitats et des terres. Tout à coup, les gens considèrent l'inventaire des terres comme absolument nécessaire. Je crois que votre tour est arrivé; les cinq ou dix prochaines années nous donneront de bons programmes d'inventaires du territoire au Canada.

Il ne me reste qu'à vous souhaiter la meilleure des chances, à vous rappeler que nous attendrons vos recommandations avec impatience et à vous remercier.

THE "WHAT" AND "WHY" OF HABITAT INVENTORY

R. D. Jakimchuk
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INTRODUCTION

There is only one thing certain about any habitat inventory: it is never just right for the users' needs and it will never be used according to the limitations which are meticulously identified by its authors. This is the burden we share and represents the scope of the challenge before this workshop.

In its most elemental form, a habitat inventory may be the known distribution of a species over its North American range or a map of major biotic communities. Even today, for vast areas of the continent we often rely on the most general species distribution maps for providing the only insight into the expected use of land or water by wildlife and fish. In other cases we have more sophisticated measures of productivity, numbers, component habitats, intensity and periodicity of use. We face the additional dilemma: in our attempts to organize and classify we often obscure by compartmentalizing ecological relationships which go beyond our conventional habitat categories. I hope, in this background discussion, to at least identify some of the problems and limitations of the past and to raise questions as to how we might advance our approaches in the future. This is the goal of this workshop and it is a timely and worthwhile undertaking.

WHAT IS A HABITAT INVENTORY AND WHAT SHOULD IT BE?

The most important underlying premise is to recognize that habitat inventory is part of a process and not an end in itself. The tendency to classify is inherent in all scientific endeavours and, in considering wildlife habitats, it is far easier to develop a system of classification than it is to assure applicability of the information generated to scientific, social and management needs.

What, then, are the fundamental questions asked of an inventory, and to what use are the answers put? First, we want to know where animals are, or where they could be; when are they there, what they need to survive, how many there are, and how much space (habitat) of what type they need to maintain a given population level. What constraints to their survival does the habitat impose or would changes in that habitat impose? Thus, while we are inventorying habitat, which is represented by living space, food and shelter for organisms, usually in terms of landform and vegetative associations, we are really asking questions and making assessments of the inhabitants of those habitats whether they be fish or wildlife.

An enormous range of complex considerations enters this process for we know that requirements differ widely for species and that factors apart from forage, cover and space govern free-ranging populations. For example, winter range measured in a relatively few available hectares may be a critical requirement for the survival of a population of bighorn sheep but is a non-limiting resource on a caribou population. Inter- and intraspecific competition, predation and behavioural requirements constantly govern the status of

populations using habitats, not to mention climatic and successional factors. These complexities then make it difficult to readily categorize habitat-population relationships, yet this is the fundamental question asked of our inventories and the fundamental building block of our data bank on relationships within ecosystems.

We can make some serious errors in our assessments if we do not provide adequate consideration to the total range of biological imperatives of the organisms whose habitats we classify and inventory. And, as we all know, this is neither readily nor easily accomplished but proceeds at a somewhat glacial pace as our general ecological understanding accumulates. This brings me to the point that I will elaborate on later: habitat inventories should be both a vehicle for increasing our ecological knowledge, and must, at least, incorporate current scientific findings on ecological relationships. I think we have all been guilty of not "keeping up" with the scientific literature - a formidable task in even a narrow field today. Yet I think one of the major failings of habitat inventory programs and derived classifications in the past is that they often reflect "truisms", or rules of thumb which may not, in fact, <u>be</u> true, or accurate, or even reflect the most up to date findings in the fields of animal ecology. We must incorporate as much as possible the knowledge of what is important about habitat to the welfare and productivity of animal populations. One of my criticisms today of C.L.I. classifications (with which I was closely involved in the early '60s) is the emphasis given to soil or parent material fertility as a criterion of capability to support wildlife. I readily acknowledge that in general (at the biome level, for instance) fertility of soils correlates with biomass production; that is, the primary productivity of either aquatic or terrestrial ecosystems. However, I think the concept was over-emphasized in C.L.I. - a seven class system where fertility limitations were often used for land units within a few miles of each other. Despite the apparent logic of the fertility criterion, it can be over-emphasized when one considers some of the other ecological limitations governing habitat use that I referred to earlier (such as competition and predation), which may exert a far greater influence on populations within the same biome than do slight variations in primary productivity. In comparing an Arctic to a tropical ecosystem, fertility factors demonstrably reflect great differences in primary productivity and carrying capacity. However, in comparing the capability of biophysical units for white-tailed deer in the aspen parkland, fertility as a criterion does not lend itself to the fine degrees of productivity distinction implied by a 7 class capability system.

Thus, in habitat classification we should critically examine the criteria used to differentiate habitat quality. We may use conventional wisdom with good intentions and miss the point completely as to what constitutes a "habitat" for the species, or group, under consideration. We should also be prepared to discard irrelevant criteria and incorporate new concepts as they are demonstrated to be valid.

Let me give an example: In the early 1970s, an international symposium on caribou was held in Alaska. At the time considerable attention was given to the effects of proposed northern pipelines on caribou habitat, and the effects of range disturbance was also discussed as a serious constraint on caribou populations. Despite that focus, caribou populations were in a serious decline in Alaska from the effects of hunting and predation. The Trans-Alaska pipeline was subsequently built coincident with a program of harvest restrictions and predator control. The two separate caribou herds directly associated with the pipeline have shown a consistent increase in numbers (about double today) which commenced during the period of pipeline construction and has continued to date. The conclusion is not that pipelines increase caribou populations. The control of hunting and predators were pivotal in reversing population declines despite the concern for other factors associated with industrial development. While international focus was given to potential developmental

conflicts and range considerations, populations were declining for different reasons that did not "fit" the conventional wisdom of the day. It is incumbent on us, then, to be critical in our use of classification criteria and not be seduced by adherence to principles which are not limiting on a particular species or group.

MAJOR INVENTORY PROGRAMS OF THE PAST

Over the past twenty years, several extensive and intensive habitat inventories have been conducted in Canada. The Canada Land Inventory and the ALUR Arctic Land Use Mapping program are extensive in scope. The CLI like most biophysical systems is essentially "range" or "productivity" oriented. Land systems are classified according to their inherent productive capability for a species or related group of species. The strength of that rationale is that it deals with discrete, ecological units and reflects assemblages of soil, terrain and vegetation which may be identified based on biological or physical characteristics. It is designed to reflect capability under optimal management versus other differing biophysical units. Its weakness is that it does not reflect the other factors which constitute habitat requirements for a species and does not take into consideration other biological needs which are as important as "carrying capacity" to the numbers and distribution of wildlife. For example, biophysical units do not encompass the large home range of migratory mammals, birds or some fish species. In many cases they do not account for specific behavioural requirements, predator refugia, travel corridors, or spacing requirements (territoriality) of certain species at given times of the year. On the other hand, if properly designed, they provide a more objective assessment of habitat importance than can be reflected in a point in time population estimate which may fluctuate dramatically from year to year.

A precursor to the ALUR series was Arctic Ecology Map Series - a primitive attempt to collate known information on Arctic populations and habitats. The body of known information was woefully inadequate. The subsequent widely published ALUR series retained several important concepts of that initial attempt at differentiating arctic habitats:

- It distinguished (and defined) important versus critical areas.
- It was a simple species categorization.
- It contained provision for seasonal movements.
- It recognized seasonal changes in habitat use over large areas.
- It distinguished habitat function as breeding, wintering, calving, etc.

As the author of the Arctic ecology series, I have a particular bias for the approach taken. I do not wish to dwell on the point except to say that the foregoing, while basically a distributional/abundance system, recognized factors which constitute habitat for populations which are often highly mobile and which cannot be pigeonholed into a localized "habitat". It recognized that form (denning sites, suitable soils for denning), and function - migratory routes and periodicity (seasonal use) are as much a habitat criterion as grams/sq. m/year of primary productivity. Now I realize that biophysical classifications endeavour to make the same inclusions. They are, however, often constrained by the scale of unit boundaries which, for mammals with large home ranges, migratory fishes and birds, is difficult to accommodate. The point is this: a habitat is not a single place but a concept describing interactions which vary in space and time. The closer we can come to reflecting this in our inventories, the better our work will be!

There has been a positive evolution in existing inventory methodology over the past decade: in British Columbia, for example, population and browse surveys for ungulates supplement biophysical ratings; distinctions are made between summer ranges which are often extensive and winter ranges which are more restricted in extent.

In Banff and Jasper Parks, Geoff Holroyd and his colleagues and others have described representative communities of small mammals and passerine birds which are associated with biophysical units and have

supplemented their delineations with actual use indices (pellet group counts) by ungulates. This approach is time consuming and more feasible for regional inventory than inventories on a national scale, but it represents a positive direction. Inventories have been broadened to include a wider range of species than was considered in the initial CLI inventory - also another positive step. The Mackenzie Valley and Northern Yukon inventories conducted by the C.W.S. in the early 1970s have provided supplementary baseline data on numbers and potential impacts associated with industrial development.

All of the baseline data mentioned above will serve as a basis for future comparisons of the status of populations in unmanipulated populations.

In our vast Arctic and sub-Arctic wildlands in Canada there is a pressing need for even the most basic information on use of various vegetation communities by wildlife. We can broadly categorize communities in a systematic way but we need to supplement this with a systematic sampling of various biophysical assemblages to understand the characteristic use and species composition associated with major habitat types. The data base on distribution and numbers in the Arctic is much smaller than in southern Canada and we cannot apply the same assumptions to our classifications. At present I think that such systematic sampling information for major or typical communities, similar to the approach taken by Holroyd, would be more useful than a systematic mapping and rating of vast areas based on biophysical criteria alone.

In short, we need to know more about habitat use by all species and how it varies in the north before we can develop the appropriate criteria for a broad inventory program. What, for example, are the bird and mammal communities associated with shrub tundra versus open black spruce forest? We need to have a data base of "reference" communities incorporating as much biological detail as possible. We will always be faced with the capability - population conundrum: should we inventory based on capability and accept the limitations of that approach, or should we use current populations as a measure of habitat use and quality? Both approaches have obvious limitations - but by tackling these simultaneously, we will broaden the usefulness of habitat inventory to a wider range of users.

I cannot stress strongly enough that adequate sampling, testing of our assumptions and building a credible baseline data base is the key to improving our methodologies and the usefulness of the end product.

WHO ARE THE USERS?

A good list of potential users was presented in the User Needs Survey circulated by the CCELC last summer. The three broad categories were: Land Use Planning, Environmental Impact Assessment, and Fish and Wildlife Management. In perusing the sub-headings within these categories I felt that, in general, although overlap is inevitable, there are distinctly different underlying premises of need for the major potential user groups.

It seems to me that wildlife inventory applications in land use planning are predicated primarily on social values which might range from bird watching opportunities in urban parks to concern for a rare and endangered species. Thus, information needs are not as systematic as they would be otherwise. Applications are regional or local and tend to reflect community concerns. In short, I do not think we make wildlife habitat use plans or strategies on a national or provincial basis as much as on a case basis.

Second, I think the underlying premise of Environmental Impact Assessment is to identify the present status of habitat use. Maintenance of the status quo of potentially affected populations and habitats by mitigating adverse impacts dictates the application of data. In addition, needs for impact assessment are to provide a perspective on how potentially affected habitats compare with alternative sites or routings. Third, for Fish and Wildlife Management,

wildlife values themselves, particularly for harvestable species are emphasized. The general goal of wildlife agencies is to maximize wildlife production by management of both populations and habitats. That user group may find the greatest applicability in using habitat classifications as a basis for stratifying population surveys, to develop management programs and priorities and to identify threats to habitat within their jurisdiction. Of all users, Fish and Wildlife Management have the greatest need for an inventory in the sense of a systematic catalogue. Questions pertaining to harvest and numbers are usually dealt with as individual population assessments, rather than on a biophysical inventory basis.

The existence of these differing underlying premises will dictate both the use made and the usefulness of habitat inventory information.

It would be worthwhile, then, to consider different approaches to the habitat inventory process according to geographic regions and known priorities of major user groups. For example, I think that our level of need for remote wild lands like we find in the Arctic and sub-Arctic areas is somewhat different than our requirements in accessible wild lands such as those accessible by road or by human populations engaged in hunting or recreation. I think our needs are also different again in settled areas of the country.

I would not want to see us attempt a systematic inventory of the Arctic that would take 20 years to show results. That is why I suggested that we should typify reference communities to give us some understanding of what is happening and then deal with requirements on a case basis. What I have called our "accessible wildlands" is the best area for combining a bio-physical classification with population inventory information. In our settled areas I'm concerned as we all are for habitat attrition owing to agriculture and other activities. Perhaps our greatest need is to identify by characteristic areas what that rate of attrition is. Once again, we may have to sample areas of Aspen parkland to see what the rate of clearing is or what the rate of drainage of wetlands is in a given year as a basis for monitoring losses over time. Our priorities then are not so much a need for bio-physical classification as they are to identify rates of loss and how these can be stemmed. Perhaps our greatest need is simply a tabulation of the extent of available wildlife habitat rather than rating the capability of areas that are under agriculture. These are questions to ponder as we go through the next few days.

NEEDS FOR THE FUTURE— AN APPROACH

I have only touched on some of the variables which govern the needs and applications of habitat inventory information. These will vary according to species considered, the major goals of the user and the level of biological baseline data available. Having come full circle I would like to summarize my thoughts on the questions What and Why:

1. We need to address the population/capability conundrum - perhaps by treating species with large home ranges in a different manner than those which are resident within smaller areas.

2. In order to advance our knowledge of trends and actual use we need to generate and update baseline information from all available sources as an adjunct to our inventory and classification information. For example, in the past decade consulting firms and industry has generated an enormous amount of baseline information for various locations which should be integrated with our baseline information data bank. These data can serve as an index for future comparison.

3. We need not only to describe the total faunal community in our habitat designations, but to define their interactions.

4. We need to continue to broaden the scope of our assessments to include the non-game species which are part of every habitat complex.

5. We need to incorporate research to test premises of habitat-population

relationships, either from the general scientific literature or as specific programs which parallel the inventory process itself. Good habitat appraisal is good science.

6. We have to modify approaches as necessary to provide the most meaningful information to user groups.

7. If we inventory and classify habitat in an integrated way (where data is reduced to rating systems) our parameters, criteria and baseline data should be available to the user who requires non-reduced information. We will maximize the usefulness of our costly field endeavours in this way.

8. We need to deal with successional change as it affects habitat quality over time or following severe environmental perturbation such as fire. Incorporation of such information into the inventory will add significantly to the value of the inventory to the user.

Throughout this paper I have alluded to the "WHY" of habitat inventory as a functional tool in our understanding and management of fish and wildlife populations. The question has even a more basic and important answer. In a world of competing resource uses and other human pressures, we need the knowledge provided by our inventories to maintain and protect our wildlife populations. Not only for their sake, but for ours, as our own values and life quality are enhanced considerably by their presence. It is a task worthy of our best efforts.

DISCUSSION

LEE LEWIS

Ron, you alluded to some concerns that you had when we were structuring the Arctic guidelines. Could you elaborate on them? Obviously you're concerned for migratory animals as a specific interest to you. Could you possibly give us some information on that?

RON JAKIMCHUK

I was identifying the fact that it is very difficult for us to accommodate all species and all interests in one classification system. We have to recognize that, for some species, for example caribou, it is much more realistic and meaningful to deal with them as individual populations rather than to inventory their habitats, for a number of reasons. In general, habitats for caribou in North America are not limiting. They are not limiting to the extent that wolf predation and human kill are. Caribou will range over land areas as large as 100,000 sq. km so it does not make as much sense to use a bio-physical approach to try to categorize a caribou population as it would for a white-tailed deer population. We have to take the differences into account. We have to take into account such situations as here in Banff where the winter range for elk is right along the Bow Valley but their summer range is dispersed at higher altitudes some distance from the bio-physical units which are classified in the valley. Migratory routes, behavioural requirements and other characteristics of individual species must be incorporated into our classification criteria or we will be locked into the types of classifications that are developed for agriculture and forestry which do not always coincide with our needs.

GLEN ADAMS

Would you favour the inclusion of indicator species to indicate particular communities or subdivisions of these land systems and how would you determine these indicators if you used them seeing as you cannot possibly utilize or inventory all species or their requirements? Would you use the effects of environmental perturbations and how they influence the particular species and which reacts most to these perturbations or what would you suggest?

RON JAKIMCHUK

I'm not suggesting that we inventory all species for all bio-physical units because that is a task that is unending and could not be done within our lifetime, but that we have reference communities so that we know what the typical species composition is, for a given community or bio-physical unit. We know something about the species composition and about the relative numbers at various seral stages. For example, in the Northwest Territories, Black Spruce Forest will have far different mammalian community after fire than it does in a climax state. I think we can characterize these by doing some original research sampling of bio-physical units as has been started by Holroyd in Banff and Jasper. From the general scientific literature there is a lot known of variations in numbers and species composition in response to environmental change. These considerations should be identified so that when a fire does sweep through an area the user will know what to expect 5 years or 50 years after the fire. By doing this I think it would be an important first step in recognizing the totality of the inter-relationships that are going on not only between the animals and their environment but the interactions between the animals themselves which are important.

DAVID RIMMER

I was interested in your last point. It is one that has always bothered me, is a rating system vs. the raw data. I was wondering what your thoughts were on whether we should ever even include a rating system in an inventory or perhaps we should have an inventory or an inventory management type system whereas the inventory itself isn't involved only in collecting raw data and that's it and then it is the user's responsibility to do with it as he wishes.

RON JAKIMCHUK

You have touched upon the major dilemma that we face in this question of mapping and drawing units and applying some kind of a rating to them. I don't think that we can avoid that. I think biologists are in the best position of making the types of evaluation of the quality of data that other users require. I am not suggesting that we discard ratings entirely but that we should not lose the baseline data that is generated to produce a derived classification. Those numbers are important. If, for example, you go today and inventory the MacKenzie Valley where the CLI group did their beaver survey, you will know what lodge densities per mile of stream were in an area eight or ten years ago and can compare them with current numbers. We must find a way of saving the baseline data that has been incorporated into the classification system so that it is available as an index for future measure as well as for the user who might require something more than a simple numerical rating. It is not an easy thing to accomplish but there are many ways like computer storage or accompanying appendices that can retain that detailed information. I think it should be there.

GEORGE COLLIN

You referred several times to the incorporation of additional elements into a manageable land unit and you mentioned that you thought that parent material and soils perhaps were not as critical for a wildlife habitat unit and you seemed to be emphasizing surface cover types. I was wondering whether you could indicate what you felt are the major bio-physical elements that should go into the final habitat unit that is used for inventorying?

RON JAKIMCHUK

Well, we are talking about two things. We are talking about what defines the boundaries of our classification unit. It may be a vegetative community or it

may be a bio-physical landform or soil unit. I have indicated that I think in the past we have tended to be biased by fertility considerations, that is, quality of the parent material, when there are other physical factors that are perhaps more significant. You will have an opportunity on the field trip with Geoff Holroyd to look at bio-physical units that are on the south-facing slopes of the Bow Valley and the same bio-physical units on the north-facing slopes. I think there is one called Fireside that is on the north side that is a virtual biological desert because of the differences in exposure of the same combinations of parent materials. The north facing units have a consistently lower capability than the same unit does on the south side of the valley. These are the types of things we have to take into consideration or our classification will not clearly reflect habitat capability.

ROBIN USHER

I am interested in the point that you raised that you feel that we should use different approaches for different users. I would like you to elaborate by way of example if you could, given that you had a socio-economist interested in a given area and a biologist as well, what sort of approach would you use for both those different users?

RON JAKIMCHUK

Well, that is starting to get fairly detailed I think. Don't forget I'm posing the questions for you people. I don't have all the answers.

ROBIN USHER

Why I asked that question is I wonder how feasible it is, how workable it is. I think it is a good idea.

RON JAKIMCHUK

Well, I have a viewpoint that we do not do land use planning with respect to wildlife on a national or provincial scale. Based on the evidence that I have seen, I don't think that things fall into that orderly systematic way. I think that we do things on a case basis when it comes to environmental impact studies or social needs. You will not find your regional wildlife biologist making references to the CLI capability maps. He has his own measures of what is happening in his district. So, we need some kind of a base that is appropriate to different user groups rather than a single classification for all user groups. That is why I made the distinction that perhaps we should look at settled areas, accessible wildlands and remote wildlands in different ways. They represent the major differences in the way we use and need inventory information. A socio-economist may also have differing data requirements depending on his interests. These might best be met by additional baseline data, and inclusion of a broader range of species than I referred to in my presentation. To give you a case in point, I think that capability classifications for large areas of Prairie parkland are not as meaningful as knowing how many hectares of aspen there are for white-tailed deer within a township and what the rate of loss is. The way we gather information and the way we tabulate it should reflect some of these differences rather than for us to try to develop an omnibus classification that is as applicable in Nova Scotia as it is to the Northern Yukon.

GAÉTAN GUERTIN

I will try to ask my question in English. You gave us some principles and examples for land ecology. Is it applicable to aquatic ecology?

RON JAKIMCHUK

Well, I'm not a fisheries biologist, but I think that the principles I am talking about at the general level are applicable. I think that a lot of the things I have said apply

to aquatic ecosystems as well. The limiting factors may be somewhat different and of course the nature of the habitat is quite different but the principles involved are similar.

L'ABC DE L'INVENTAIRE DES HABITATS

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INTRODUCTION

Une seule chose est sûre à propos des inventaires des habitats: ils ne conviennent jamais aux besoins des usagers et ils ne seront jamais utilisés en fonction des limites énoncées avec soin par les auteurs. Voilà le fardeau que nous devons porter et cela constitue le défi que nous devons relever.

Dans sa forme la plus élémentaire, un inventaire des habitats peut être la répartition connue d'une espèce dans son aire nord-américaine ou une carte des grandes communautés biotiques. Même aujourd'hui, pour de grandes parties du continent, nous comptons souvent sur des cartes de répartition des plus élémentaires pour avoir une idée des utilisations attendues des eaux et de la terre par la faune. Dans d'autres cas, nous disposons de moyens plus perfectionnés, d'évaluation de la productivité, des populations, des habitats, de l'intensité et de la périodicité de l'utilisation, etc. Nous faisons alors face à un autre dilemme: en tentant de tout organiser et de classifier, nous nous égarons souvent en compartimentant les rapports écologiques qui sortent des catégories habituelles d'habitat. J'espère du moins déterminer quelques-uns des problèmes et des limites du passé et soulever des questions sur la façon dont nous pourrions mener notre barque, à l'avenir. C'est là le but de notre atelier, approprié et louable.

QU'EST ET QUE DEVRAIT ÊTRE UN INVENTAIRE DES HABITATS?

Avant toute chose, nous devons reconnaître la réalité sous-jacente, c'est-à-dire l'inventaire est une partie d'un processus et non pas une fin en soi. La tendance à classifier est inhérente à tous travaux scientifiques; en ce qui concerne les habitats fauniques, il est beaucoup plus facile de mettre sur pied un système de classification que de garantir l'applicabilité des informations produites à des besoins scientifiques, sociaux et gestionnels.

Or, qu'attendons-nous avant tout d'un inventaire, et à quoi serviront les réponses? D'abord, nous voulons connaître les endroits occupés par les animaux ou susceptibles de l'être, les périodes d'utilisation des différents endroits, les facteurs nécessaires à leur survie, leur nombre, la superficie des terres (habitat) et les types d'habitats requis pour assurer le maintien des populations. Quelles contraintes leur impose leur habitat? Quels seraient les effets de changements? C'est donc dire que, lorsque nous inventorions les habitats - soit l'espace extérieur, la nourriture et l'abri des organismes vivants, normalement sous forme de paysages et d'associations végétales - nous nous posons des questions et évaluons les habitants de ces territoires, qu'il s'agisse de poissons ou de mammifères.

Il entre dans ce processus un très grand nombre d'éléments; nous savons en effet que les besoins diffèrent d'une espèce à l'autre et que des facteurs autres que ceux touchant à la nourriture, au couvert et à l'espace déterminent les mouvements des populations errantes. Par exemple, une aire de dispersion hivernale de quelques hectares peut avoir une importance primordiale pour la survie d'une population de mouflons d'Amérique mais ne constitue pas un facteur limitatif pour des caribous. La concurrence inter et intraspécifique, la prédation et les nécessités du comportement déterminent constamment l'état des populations qui utilisent des habitats, sans parler des facteurs climatiques et ceux qui sont liés à l'évolution écologique. Ces éléments complexes rendent difficile la catégorisation immédiate des rapports entre les habitats et les populations qu'ils abritent; c'est pourtant la question que l'on pose avant tout à nos inventaires et cela constitue la pierre angulaire de notre banque de données sur les rapports dans les écosystèmes.

Nous pouvons faire de graves erreurs dans nos évaluations si nous ne tenons pas suffisamment compte de l'ensemble des impératifs biologi-

ques des organismes dont nous classifions et inventorions les habitats. Comme nous le savons, cela ne se fait pas automatiquement ni facilement mais très lentement, à mesure que nous acquérons des connaissances sur l'écologie. Cela m'amène au point sur lequel je m'étendrai plus tard: les inventaires des habitats doivent à la fois être un moyen d'accroître nos connaissances écologiques et comporter, au moins, des découvertes scientifiques sur les rapports écologiques. Je crois qu'il nous est impossible à tous de nous tenir au fait de la littérature scientifique - tâche devenue formidable, même dans un domaine restreint comme le nôtre. Je pense que l'une des grandes faiblesses des programmes d'inventaire des habitats et des classifications qui en ont été tirées est qu'ils sont souvent fondés sur des truismes ou des règles empiriques qui, en fait, peuvent être fausses ou encore erronées ou n'être pas fondées sur les dernières connaissances en matière d'écologie animale. Dans la mesure du possible, nous devons consacrer nos connaissances sur les éléments importants des habitats au bien-être et à la productivité des populations animales. Je reproche, entre autres, aux classifications de l'ITC (auquel j'ai travaillé de près au début des années 60) de trop s'appuyer sur la fertilité du matériau d'origine ou du sol pour l'évaluation du potentiel faunique d'un territoire. Je reconnais volontiers qu'en général (et en particulier au niveau du biome), la fertilité du sol est en rapport avec la production de la biomasse, c'est-à-dire la productivité primaire des écosystèmes aquatiques ou terrestres. Je crois toutefois que l'on a trop poussé le principe pour l'ITC - système qui comporte sept catégories dans lequel on fixe souvent des limites de fertilité à des terres qui se trouvent à quelques milles les unes des autres. Le critère relatif à la fertilité est logique, en apparence, mais peut être exagéré; il suffit de penser à quelques-unes des autres limites écologiques touchant l'utilisation des habitats, dont j'ai parlé plus tôt - par exemple la concurrence et la prédation - qui peuvent avoir un effet beaucoup plus grand sur les populations d'un même biome que de légères variations de la productivité primaire. Lorsque l'on compare un écosystème arctique à un écosystème tropical, les facteurs de fertilité montrent de façon frappante d'importantes différences entre la productivité primaire et la capacité de charge. Cependant, en comparant le potentiel des unités biophysiques pour le cerf de Virginie, dans une forêt-parc de trembles, on s'aperçoit que la fertilité ne se prête pas aux subtiles distinctions concernant la productivité rendues nécessaires par un système comportant sept catégories.

Donc, pour classifier les habitats, nous devons examiner d'un oeil critique les critères employés pour déterminer différentes qualités d'habitats. Nous pouvons avoir recours au bon sens et être bien intentionnés et quand même ne pas réussir à déterminer ce qui constitue un habitat pour l'espèce ou le groupe visé. Nous devons en outre être prêts à nous défaire de critères inutiles et à prendre en compte de nouveaux principes dont la valeur a été prouvée.

Je vous donne un exemple: au début des années 70, on a tenu en Alaska un symposium international sur le caribou. On a alors accordé beaucoup d'attention aux effets d'éventuels pipelines sur l'habitat du caribou dans le Nord; on a aussi parlé de la perturbation des aires de dispersion et de ses graves effets sur les populations de caribous. Or, à la même époque, les populations de caribous d'Alaska étaient sérieusement en baisse, par suite de la chasse et de la prédation. Ensuite, parallèlement à la mise en place d'un programme de restriction des prises et de limitation des prédateurs, on a entrepris la construction du pipeline de l'Alaska. Depuis le début des travaux et jusqu'ici, les deux hardes touchées par la construction ont vu leur nombre s'accroître de façon régulière, jusqu'au double de ce qu'il était avant les travaux. Il ne faut pas en conclure que les pipelines font augmenter les populations de caribous. En fait, ce sont la limitation de la chasse et des prédateurs qui ont été les facteurs déterminants de l'augmentation subite des populations, et ce malgré les incidences redoutées du développement industriel. L'attention internationale était tournée vers les éventuels effets de travaux industriels et des considérations relatives aux aires de dispersion, les populations baissaient pour des raisons qui ne cadraient pas dans le bon sens du moment. Il nous incombe donc de faire preuve de discernement pour le choix des critères de classification et de ne pas être trompés par des principes qui ne se limitent pas à une espèce ou à un groupe.

PRINCIPAUX INVENTAIRES DÉJÀ RÉALISÉS

Au cours des vingt dernières années, plusieurs inventaires à la fois intensifs et de grande envergure ont été réalisés au Canada. L'inventaire des terres du Canada et le programme de cartographie pour l'utilisation des terres du Nord, RUTA, ont une portée très étendue. L'ITC, comme la majorité des systèmes biophysiques, est essentiellement axé sur l'aire de dispersion et la productivité. Les systèmes terrestres sont classifiés selon leur capacité inhérente de production par rapport à une

espèce ou à un groupe d'espèces connexes. L'avantage de cette formule réside dans le fait qu'elle touche à des unités écologiques distinctes et qu'elle tient compte de combinaisons de sols, de reliefs et de végétations identifiables par le biais des caractéristiques biologiques ou physiques. Elle est conçue pour montrer la capacité d'une unité, dans des conditions d'aménagement optimales, et comparer cette capacité à celle d'autres unités biophysiques. Elle a cependant le défaut de ne pas tenir compte des autres facteurs qui constituent les besoins en habitat d'une espèce ni d'autres besoins biologiques qui, pour les populations et la répartition des espèces, sont aussi importants que la capacité de charge. Par exemple, les unités biophypsiques ne comprennent pas les principales aires de dispersion, de grande superficie, de mammifères, de certains poissons et d'oiseaux migrateurs. Dans de nombreux cas, on ne tient pas compte des diverses nécessité du comportement, des refuges contre les prédateurs, des corridors de déplacement ou des besoins d'espacement - territorialité - de certaines espèces, à certaines périodes de l'année. Par contre, si elles sont bien conçues, les unités permettent une évaluation plus objective de l'importance des habitats que ne le permet une estimation ponctuelle de la population, laquelle peut varier considérablement d'une année à l'autre.

Avant la série de documents de RUTA, il y a eu la série de cartes écologiques sur l'Arctique, qui constituait une tentative rudimentaire de collecte de données sur les populations et les habitats de l'Arctique. Les informations disponibles étaient lamentablement insuffisantes. Dans la série ultérieure de RUTA, qui a été diffusée sur une grande échelle, on retint plusieurs principes importants de différenciation des habitats arctiques, élaborés dans la première tentative:

- distinction entre régions importantes et primordiales et définition de ces termes;
- catégorisation simple des espèces;
- dispositions relatives aux mouvements saisonniers;
- prise en compte de changements saisonniers pour l'utilisation des habitats sur de grands territoires;
- distinction des fonctions des habitats: nidification, mise bas, hivernage, etc.

En tant que concepteur de la série écologique sur l'Arctique, j'ai un penchant particulier pour la démarche employée. Je ne veux pas m'attarder sur ce point mais je dois dire que cette série, qui était fondamentalement un système touchant à la répartition et aux populations, reconnaissait des facteurs constituant des habitats de populations souvent très mobiles et qui ne peuvent être associées à un habitat localisé. Elle reconnaissait également que la forme (tanières et sols qui se prêtent à l'aménagement de tanières) et la fonction - voies migratoires et périodicité (utilisation saisonnière) - sont des critères de détermination d'habitats au même titre que la productivité primaire exprimée en grammes/m^2/année. Aujourd'hui, je m'aperçois que les classifications écologiques visent à comprendre les mêmes éléments. Cependant, il arrive souvent qu'elles sont entravées par l'échelle des unités qui sont difficiles à appliquer aux mammifères ayant des aires de dispersion principales étendues, aux poissons et aux oiseaux migrateurs. En fait, il faut se rappeler qu'un habitat n'est pas uniquement un endroit mais bien un concept qui comporte des interactions variant dans le temps et l'espace. Plus nous nous approcherons de cette définition dans nos inventaires, meilleurs seront nos résultats.

Au cours des dix dernières années, il y a eu une amélioration de la méthodologie employée pour les inventaires; par exemple, en Colombie-Britannique, des relevés des populations et des zones d'alimentation des ongulés ont été ajoutés aux cotes biophysiques établies; on a fait des distinctions entre les aires de dispersion d'été, qui sont souvent étendues, et celles d'hiver, qui le sont moins.

Dans les parcs Banff et Jasper, Geoff Halroyd et ses collègues ainsi que d'autres personnes ont décrit des communautés représentatives de petits mammifères et de passereaux liés à des unités biophysiques et ils ont fondé les limites déterminées sur des indices d'utilisation réelle par les ongulés (comptage des fèces). Cette démarche prend du temps et est plus facilement réalisable pour les inventaires régionaux que pour des inventaires nationaux; elle représente néanmoins un pas en avant. Les inventaires ont été élargis de manière à englober un plus grand nombre d'espèces qu'au début de l'ITC, ce qui constitue une autre amélioration. Les inventaires de la vallée du Mackenzie et du nord du Yukon, réalisés par le SCFaune au début des années 70, ont fourni d'autres données de base sur les populations et sur les incidences possibles du développement industriel.

Toutes les informations dont je viens de parler serviront de base de comparaison future avec des données sur les populations de régions non perturbées.

En ce qui concerne nos vastes terres sauvages arctiques et subarctiques, nous avons un urgent besoin de renseignements de base sur les utilisations des diverses communautés végétales par les animaux, sous une forme ordonnée; il faudrait cependant compléter ces informations à l'aide d'un échantillonnage systématique des différentes combinaisons biophysiques, afin de comprendre les utilisations caractéristiques et la composition des espèces liées aux principaux types d'habitats. Les données que nous possédons sur la répartition et les populations dans l'Arctique sont beaucoup moins importantes que celles dont nous disposons concernant le sud du pays; de plus, nous ne pouvons poser les mêmes hypothèses pour nos classifications. Pour le moment, je crois que des renseignements de ce genre, obtenus par échantillonnage, sur les communautés principales ou typiques, semblables à celles obtenues par Halroyd, seraient plus utiles que la cartographie et la cotation systématiques de vastes territoires, fondées uniquement sur des critères biophysiques.

Bref, avant de pouvoir élaborer des critères satisfaisants pour la réalisation d'un important programme d'inventaires, nous devons en apprendre davantage sur l'utilisation des habitats par les différentes espèces et sur la façon dont cette utilisation varie dans le Nord. Par exemple, quelles sont les communautés d'oiseaux et de mammifères liées à la toundra arbustive et celles qui sont rattachées à la forêt d'épinettes noires? Nous avons besoin d'une base de données sur les communautés de référence comportant le plus de détails biologiques possible. Nous ferons toujours face au dilemme du potentiel et de la population: devrions-nous inventorier en fonction de la capacité et accepter les limites de cette méthode ou encore utiliser les populations actuelles comme mesure de l'utilisation et du nombre d'habitats? Ces deux démarches ont des limites évidentes; pourtant, en y recourant simultanément, nous rendrons les inventaires d'habitats plus utiles à davantage d'utilisateurs.

Je ne saurais insister suffisamment sur le fait que l'échantillonnage et la mise à l'essai de nos hypothèses ainsi que la mise sur pied d'une base de données fondamentales et fiables sont les seuls moyens d'améliorer nos méthodologies et d'assurer l'utilité du produit fini: l'inventaire.

LES UTILISATEURS

Au cours de l'été dernier, le CCCET a fait circuler une liste des utilisateurs potentiels, dans le cadre de l'enquête sur les besoins des utilisateurs. On y trouve trois grandes catégories: planification de l'utilisation des terres, évaluation des incidences sur l'environnement et gestion de la faune. Je me suis aperçu, en examinant les sous-titres de ces catégories, qu'il y a en général différents besoins sous-jacents chez les principaux groupes d'usagers potentiels, même si le chevauchement est inévitable.

Je considère d'abord que les applications des inventaires fauniques à la planification de l'utilisation des terres visent principalement des valeurs sociales allant de l'ornithologie dans les parcs urbains à des préoccupations concernant des espèces rares ou menacées d'extinction. C'est donc dire que les besoins en informations ne sont pas aussi systématiques que l'on pourrait le croire. Les utilisations des inventaires sont d'ordre régional ou local et tendent à être fonction des préoccupations des collectivités. En fait, je ne crois pas que nous fassions des plans ou des stratégies d'utilisation des habitats fauniques à l'échelle nationale ou provinciale mais plutôt en fonction des différents cas.

Deuxièmement, je pense que le but implicite de l'évaluation des incidences sur l'environnement est de déterminer la situation actuelle de l'utilisation des habitats. Pour préserver des populations et des habitats susceptibles d'être touchés par des activités, en atténuant les effets néfastes de ces dernières, il faut avoir recours à des données. En outre, l'utilisation des données en question pour l'évaluation des incidences donne une idée de la façon dont les habitats visés se comparent à d'autres emplacements ou trajets. Troisièmement, en ce qui concerne la gestion de la faune, ce sont les valeurs fauniques elles-mêmes, en particulier celles des espèces exploitables, qui sont mises au premier plan. Le grand but des organismes de gestion de la faune est de maximiser la production par la gestion des populations et des habitats. Ce groupe d'utilisateurs pourra tirer le maximum des inventaires en employant les classifications d'habitats comme base pour des relevés de différentes populations, pour mettre sur pied des programmes de gestion et élaborer des priorités et pour déterminer les menaces posées aux habitats, dans leur aire de compétence. De tous les usagers, ce sont les personnes chargées de la gestion de la

faune qui ont le plus besoin d'un inventaire présenté sous une forme systématique. Normalement, les questions relatives aux prises et aux nombres d'individus sont traitées dans le cadre d'évaluations de populations distinctes, et non pas en fonction d'inventaires biophysiques.

Ces différentes raisons détermineront l'utilisation et l'utilité des renseignements contenus dans les inventaires des habitats.

Il serait donc utile d'envisager différentes démarches pour le processus d'inventoriage des habitats, en fonction des régions géographiques et des priorités connues des principaux groupes intéressés. Par exemple, je crois que nos besoins concernant les terres sauvages reculées, comme celles de l'Arctique et des zones subarctiques, sont différents de ceux qui touchent à des terres sauvages accessibles par route, pour la chasse et le divertissement. De même, je considère que les besoins diffèrent encore pour les régions habitées du pays.

Je ne voudrais pas que nous nous engagions dans un inventaire systématique des régions arctiques, dont les résultats prendraient 20 ans à sortir. C'est pourquoi je propose de déterminer des types de communautés de référence, afin d'acquérir une compréhension de la chose, et de s'occuper des besoins particuliers dans chaque cas. Ce sont les terres sauvages accessibles qui permettent le mieux de combiner la classification biophysique à des informations sur les inventaires des populations. En ce qui concerne les régions habitées, je me préoccupe, comme vous tous, de l'appauvrissement des habitats causé par l'agriculture et d'autres activités. Le besoin le plus urgent est peut-être de déterminer le rythme et la gravité de cet appauvrissement, par région. Il se peut que nous ayons à échantillonner encore des parties de la forêt-parc de trembles, pour déterminer le rythme de défrichement ou encore évaluer le drainage des terres humides, en une année donnée, afin de surveiller les pertes à longue échéance. Dans ce cas, notre but n'est pas autant de faire une classification biophysique que de déterminer les rythmes d'appauvrissement et de chercher les moyens de les freiner. Peut-être avons-nous davantage besoin d'une liste systématique des habitats fauniques disponibles que d'une catégorisation des aires utilisées à des fins agricoles. Voilà des questions auxquelles nous pourrons réfléchir au cours des prochains jours.

BESOINS FUTURS

Je n'ai abordé que quelques-unes des variables qui régissent les besoins en matière de données sur les inventaires des habitats et leurs utilisations. Elles varient d'une espèce à l'autre, selon les principaux buts des usagers et la qualité des données biologiques de base disponibles. Étant revenu à mon point de départ, j'aimerais résumer ma pensée sur les habitats:

1. Nous devons nous attaquer au dilemme du potentiel et de la population, peut-être en abordant les espèces qui occupent de grands espaces différemment de celles qui demeurent dans des zones plus petites.

2. Pour mieux connaître les tendances et les utilisations réelles, nous devons produire et mettre à jour des informations de base à partir de toutes les sources possibles et les intégrer à nos données sur les inventaires et la classification. Par exemple, au cours de la dernière décennie, les firmes d'experts et l'industrie ont produit une quantité considérable d'informations fondamentales sur divers secteurs, qui devraient être intégrées à notre banque de données. Elles pourront servir pour comparaison future.

3. Non seulement devons-nous décrire la totalité de la communauté faunique des habitats qui nous intéressent, encore faut-il exposer les interactions.

4. Nous devons continuer d'élargir la portée de nos évaluations de manière à englober les espèces qui ne sont pas considérées comme gibier et qui font partie de tout ensemble d'habitats.

5. Nous devons étudier les fondements des rapports entre les habitats et les populations, en nous basant sur la documentation scientifique générale ou dans le cadre de programmes particuliers menés parallèlement au processus d'inventoriage. Il est de bonne pratique scientifique de faire de bonnes appréciations d'habitats.

6. Au besoin, nous devons modifier nos méthodes de manière à fournir aux usagers les renseignements les plus utiles.

7. Si nous inventorions et classifions les habitats de manière intégrée (dans laquelle les données sont exprimées selon un système de cotation), il faut mettre nos paramètres, nos critères et nos données de base à la disposition de l'usager, qui a besoin de renseignements

intégraux. C'est de cette façon que nous maximiserons l'utilité de nos coûteux efforts sur le terrain.

8. Nous devons nous occuper des changements de l'évolution parce qu'ils modifient la qualité des habitats, à la longue, ou des graves perturbations causées par les incendies, par exemple. L'incorporation de données de cet ordre à l'inventaire en augmentera grandement la valeur pour l'usager.

J'ai touché aux raisons qui justifient un inventaire des habitats en tant qu'instrument fonctionnel qui permettra d'améliorer la compréhension et la gestion des populations fauniques. En fait, la question a une réponse encore plus fondamentale et importante. Dans un monde d'utilisations concurrentielles des ressources et d'autres pressions artificielles sur la nature, nous avons besoin des informations fournies par les inventaires pour maintenir et protéger nos ressources fauniques. Et cela n'est pas seulement dans l'intérêt des animaux mais aussi dans le nôtre, étant donné que leur présence accentue considérablement notre propre valeur et la qualité de notre vie. C'est là une tâche qui mérite tous nos efforts.

DISCUSSION

Lee Lewis: Ron, vous avez fait allusion à certaines préoccupations que vous aviez au cours de l'élaboration des lignes de conduite concernant l'Arctique. Pourriez-vous préciser votre pensée? Il est évident que vous vous préoccupez tout particulièrement des espèces migratrices. J'aimerais que vous nous donniez quelques informations sur ce sujet.

Ron Jakimchuk: Je voulais dire qu'il nous était très difficile d'englober toutes les espèces et de satisfaire tous les intérêts dans un seul système de classification. Cependant, nous devons reconnaître que pour certaines espèces, par exemple le caribou, il est beaucoup plus réaliste et valable d'inventorier les différentes populations que les habitats, pour diverses raisons. En général, les habitats nord-américains du caribou ne sont pas limitatifs; par contre, la prédation par les loups et les prises par les chasseurs sont des facteurs limitatifs. Une population de caribous peut occuper un territoire couvrant une superficie de 100 000 km^2; c'est pourquoi il serait insensé de recourir à la méthode biophysique pour catégoriser une telle population, par opposition à une population de cerfs de Virginie. Nous devons tenir compte de ces différences. Nous devons être prêts à faire face à des situations comme celle de Banff: l'aire d'hivernage du wapiti longe la vallée de la rivière Bow, mais son aire de dispersion estivale se trouve à des altitudes plus élevées, à une certaine distance des unités biophysiques qui ont été classifiées dans la vallée. Les voies migratoires, les nécessités du comportement et d'autres particularités des espèces doivent faire partie de nos critères, sinon nous serons limités aux types de classification appliqués à l'agriculture et à la foresterie, et qui ne répondent pas toujours à nos besoins.

Glen Adams: Seriez-vous en faveur de la détermination d'espèces-témoins caractérisant certaines communautés ou subdivisions de leurs habitats, et comment choisiriez-vous ces groupes, sachant que vous ne pouvez en pratique inventorier toutes les espèces et leurs besoins? Tiendriez-vous compte des effets des perturbations environnementales et de la façon dont elles influent sur différentes espèces? Chercheriez-vous à savoir lesquelles réagissent le plus à ces perturbations? Que proposez-vous?

Ron Jakimchuk: Je ne propose pas d'inventorier toutes les espèces de toutes les unités biophysiques; ce serait une tâche immense pour laquelle une vie d'homme ne suffirait pas. Nous avons des groupes de référence qui nous permettent de connaître la composition typique des espèces d'un groupe ou d'une unité biophysique donné. Nous possédons des données sur la composition des espèces et sur les populations relatives à divers stades sériaux. Par exemple, la forêt d'épinettes noires des Territoires du Nord-Ouest abritera, après un incendie, une communauté de mammifères différente de celle qu'elle a en tant que forêt-climax. Je crois que nous pourrions accroître nos connaissances en faisant un échantillonnage scientifique des unités biophysiques comme celui qu'a entrepris Holroyd à Banff et Jasper. Grâce aux écrits scientifiques, nous en savons beaucoup sur les variations à l'échelon des populations et de la composition des espèces induites par des changements environnementaux. Il faudrait tenir compte de ces facteurs, de manière à savoir à quoi l'on peut s'attendre, cinq ou 50 ans après un incendie. Pour cela, je crois qu'il serait important de commencer par reconnaître l'ensemble des relations entre les animaux et la nature et les relations importantes entre les différentes espèces fauniques.

David Rimmer: Le dernier point auquel vous avez touché m'a intéressé; c'est quelque chose qui m'a toujours intrigué: un système de cotation est-il opposé à des données brutes? Croyez-vous que nous devrions introduire un

système de cotation dans un inventaire ou devrions-nous plutôt concevoir un inventaire ou un système de gestion des inventaires dans le cadre duquel l'activité ne se limiterait pas à rassembler des données brutes et à les transmettre à l'usager qui en ferait ce qu'il voudrait?

Ron Jakimchuk: Vous touchez là à un des principaux dilemmes auxquels nous faisons face pour la cartographie et la détermination des unités ainsi que la cotation de ces dernières. Je ne crois pas que nous puissions éviter ce problème. Je pense que les biologistes sont les mieux placés pour évaluer la qualité des données requises par les autres usagers. Je ne propose pas de nous défaire complètement des cotations mais je suggère de ne pas perdre de vue les données de base qui doivent servir à une classification. Ce sont des données d'importance. Si, par exemple, vous vous rendiez aujourd'hui inventorier la vallée du Mackenzie, là où l'équipe de l'ITC a fait un relevé des castors, vous connaîtriez le nombre de huttes par mille de cours d'eau qu'il y avait dans une région donnée il y a huit ou dix ans et pourriez les comparer aux chiffres actuels. Nous devons trouver un moyen de sauver les données de base qui ont été incorporées au système de classification, de manière à les rendre accessibles sous forme d'index pour des mesures futures ou à l'intention des usagers qui désirent plus que de simples cotes numériques. Cela ne sera pas facile à faire; il existe cependant de nombreux moyens d'y arriver, notamment l'entreposage en ordinateur ou la publication sous forme d'annexes; c'est ainsi que je vois la chose.

George Collin: À plusieurs reprises, vous avez parlé de l'adjonction d'éléments additionnels à des unités de terre pouvant être administrées et vous avez exprimé l'opinion que le matériau d'origine et les sols ne sont peut-être pas aussi importants qu'on le croit pour ce qui est des habitats fauniques, et vous sembliez insister davantage sur les types de couvert. J'aimerais que vous nous disiez ce que vous considérez comme les principaux éléments biophysiques qui devraient constituer une unité définitive d'habitat à des fins d'inventaire.

Ron Jakimchuk: Je crois que nous ne parlons pas de la même chose. La question que vous soulevez est de savoir ce qui détermine les limites d'une unité de classification. Il peut s'agir d'une communauté végétale, de données biophysiques sur le relief ou d'une unité de sol. J'ai dit que, selon moi, nous avions, par le passé, tendance à trop nous occuper des facteurs touchant à la fertilité, c'est-à-dire à la qualité du matériau d'origine, alors que d'autres facteurs physiques avaient peut-être plus d'importance. Lors de votre excursion sur le terrain dans la vallée de la Bow avec Geoff Holroyd, vous aurez l'occasion d'examiner les unités biophysiques des pentes faisant face au sud et de les comparer aux unités orientées vers le nord. Le secteur appelé Fireside, si je ne me trompe, qui fait face au nord est un véritable désert biologique à cause des différences d'ensoleillement des matériaux d'origine observés ailleurs. Le potentiel des pentes face au nord est constamment plus bas que celui des unités similaires orientées vers le sud. C'est le genre de choses dont nous devons tenir compte pour que notre classification reflète fidèlement le potentiel en matière d'habitats.

Robyn Usher: Vous croyez que nous devrions user de démarches différentes pour différents utilisateurs. J'aimerais que vous précisiez votre pensée et que vous nous donniez des exemples, en supposant qu'une certaine zone intéresse un spécialiste de la socio-économie et un biologiste.

Ron Jakimchuk: Pour cela, il faudrait aller trop dans les détails. N'oubliez pas que je suis venu pour soulever des questions dont je ne possède pas toutes les réponses.

Robyn Usher: Je vous ai posé cette question parce que je me demande dans quelle mesure on peut y arriver; je crois que c'est une bonne idée.

Ron Jakimchuk: Je ne pense pas que l'on puisse planifier l'utilisation des terres, en ce qui concerne la faune, à l'échelle nationale ou provinciale. Mon expérience me dit que les choses ne sont pas si simples et systématiques. En ce qui concerne les études d'impacts et les besoins sociaux, nous résolvons les problèmes un à un. Vous ne verrez pas votre biologiste régional de la faune se reporter aux cartes de potentiel de l'ITC. Il a son propre système pour évaluer la situation dans son district. C'est pourquoi nous avons besoin d'une base appropriée convenant aux différents groupes d'usagers plutôt que d'une seule classification dont tous les groupes doivent se contenter. C'est aussi la raison pour laquelle je considère que nous devrions aborder les régions habitées, les terres sauvages accessibles et les terres reculées de façons différentes. Ces types de terres illustrent bien les principales différences quant aux informations que nous utilisons et dont nous avons besoin. Un spécialiste de la socio-économie peut bien avoir, selon ses intérêts, des besoins différents en matière de données. On pourra satisfaire ces besoins

en fournissant des renseignements de base supplémentaires et en visant une gamme plus large d'espèces que celle dont j'ai parlé dans mon exposé. Par exemple, je crois qu'il est moins important de classifier le potentiel de grandes parties de la forêt-parc des Prairies que de connaître la superficie des forêts de trembles utilisables par le cerf de Virginie ainsi que le rythme de disparition. Quelques-unes de ces différences devraient se refléter dans la façon dont nous rassemblons et compilons les renseignements; il vaudrait mieux procéder de cette manière que de tenter d'élaborer un système universel de classification applicable tant en Nouvelle-Écosse que dans le nord du Yukon.

Gaétan Guertin: Vous nous avez fait part de quelques principes d'écologie des terres et nous avez donné des exemples. Est-ce que ces principes peuvent être appliqués à l'écologie aquatique?

Ron Jakimchuk: Je ne suis pas ichtyologiste mais je crois que, en général, ils peuvent l'être. Je pense en fait qu'une bonne partie de ce que j'ai dit vaut également pour les systèmes aquatiques. Les facteurs limitatifs peuvent différer et, bien entendu, la nature des habitats est bien différente, mais les principes en cause sont semblables.

WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF PURSUING AN INTEGRATED, ECOLOGICAL APPROACH TO WILDLIFE HABITAT INVENTORY?

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Having been asked and encouraged to be provocative and challenging in my comments, I like to begin by changing the title assigned to me, to something like:

"Why do Wildlife Biologists appear to have difficulties in perceiving the advantages a Resource Manager extrapolates from an integrated, multi-disciplinary Land Classification System?"

Let me attempt to answer the rephrased question with some opinions I have formed over twenty-five years of being associated with wildlife biologists. I am now convinced that the root of the stated difficulties lies primarily in the way our respective universities have taught biology, as a discipline more or less removed from other disciplines which for a variety of good reasons were forced to work together years ago. This is not to say there exists no co-operation, nor am I proposing you ignored the ecological principles generally accepted by other biological and physical disciplines. But I am saying that you were taught your science in a manner not requiring of you to integrate your findings with those of earth and vegetation scientists for the purpose of developing mutually beneficial results. I hasten to add, the excellent works of many a fine wildlife biologist of the past and present speak for themselves and will stand as important benchmarks of science for years to come. I do not assume to have the right nor knowledge to question their value. However, and for reasons not clear to me, you do not appear to have reacted with your usual vigor to the subtle changes taking place in the minds of users of your data when viewing environmental concerns. The arrival and acceptance by resource managers of classification techniques now fondly referred to as the E.L.C., somehow escaped even some of the sharpest workers in your midst. Others, who took passing notice of the changing "real world" requirements, often dismissed the new, innovative approaches to classifying wildlife as an integral part of landform-, soil-, vegetation-, etc. management, as a fad or worse still, as an uncouth way of muddying the waters of a pure science. I recognize well established traditions are difficult to change, but in the case of your profession, ten years (between 1965-1975) were literally wasted on a defensive posture that has proven itself to be costly to you.

You should now ask yourselves why did resource managers embrace the new, upstart technique of looking at the world? I offer you the suggestion that they found the results of the E.L.C. more relevant to their work and management needs than the often esoteric reports of wildlife biologists. Because the holistic view of the E.L.C. enhances a manager's opportunities to recognize relationships between quite different resource factors. This recognition in turn provides him with the base from which sounder ecological management options and alternatives can be developed. Please note that I am using the term 'sounder' in the sense of an integrated, multi-faceted view of a resource or problem. If trade-offs become necessary, they too become recognizable and defensible much quicker and better than in the past. While wildlife matters are to you the dearest topic in the world, resource managers by virtue of their task in this world must consider all issues. Furthermore, the mapping techniques of the E.L.C. force a group of scientists working within the roles of the system even prior to any actual field work, to develop a consensus on the philosophical, methodological and technological parameters which will guide their collective efforts. The very fact that extended legends for each distinct ecosite must be developed before a discrete boundary can be drawn around each polygon is perhaps the most challenging

aspect of the E.L.C. This demands compromises about hotly debated issues dear to each one of you. It is nevertheless the keystone to the understanding by the users who live and work in a world of political, social, economic and managerial compromises. To them, the minute details of science are not as important as are the ways of blending, as rationally as possible, the clamor of sometimes vociferous interest groups. I am certainly not advocating a lessening of rigor in the documentation of the truths you have so painstakingly researched, but I am pleading for your understanding of the rather special constraints any resource manager has to operate under. Your personal needs, wildlife biology's long-term needs, and a manager's immediate needs, are better served by the realization that even the best research findings may come to naught with the men and women that must deal with the broader issues of an organization, or for that matter, society as a whole. I know of hundreds of treatises that grace the bookshelves of Parks Canada's libraries alone that have had absolutely no impact on the ways wildlife is managed today, even though such works have brought academic titles and fame to their authors. I shudder at the waste of knowledge and the loss or misplacement, as the case may be, of the facts so necessary to begin to understand the complex world we live in. To make matters worse, some scientists have in their frustration I presume, attempted to usurp the prerogatives of managers. We are all well aware of the results of such fruitless pursuits. Scientists must remain scientists. They must continue to find answers to questions raised, but they must agree to leave the manager to carry out his role, no matter how distasteful that may sound to some of you. Let me add, that the opportunities do exist for members of your discipline to join the management group. I am convinced that each one of us in our chosen roles could serve mankind, and in the context of this workshop, serve the well-being of wildlife better by finding ways of co-operating more effectively. The E.L.C. is but one such vehicle available to us to achieve that elusive goal. I am also convinced that once a better integration of our respective fortes has begun, you will be called upon oftener than you are now, to research the more detailed aspects of wildlife biology and wildlife management than you would presently imagine possible. Such details are indeed necessary if managers of ecosystems are ultimately to succeed in the eyes of scientists and the public they are paid to serve. But first you must convince managers that the specific efforts of your honorable discipline do not stand alone, but rather, are an integral part of the larger whole they must concern themselves with. Earth scientists, vegetation biologists and supporting electronic data processing and mapping specialists, are well along the road to achieve just that. I am not so naive as to think this can be done easily or quickly, but I have the pleasure of knowing some of your colleagues that have in the past five years made tremendous contributions to overcome the difficulties you might also have experienced. Their efforts alone make me believe that the very special need of wildlife biologists can be satisfied within the context of an integrated, multi-disciplinary working milieu. I also believe that presently perceived difficulties with the E.L.C. will be like leaves before the wind, once you occupy your rightful place as members of the ecological land classification field teams. The advantages of pursuing that approach will become so clear to you, as to render the two discussion topics I began with, academic.

How then does one begin to achieve such a goal? Well, to begin with some sacred cows will have to be sent to pasture, personal preferences and quirks may require curbing for the sake of the greater good. New and collective working standards need setting in the light of the demands of the integrated, ecological approach; and most importantly, communication channels need clearing if we are ever going to agree that <u>your</u> wildlife habitat is equal to <u>my</u> 'vegetation association', and both occur naturally in some form of ecological state on <u>his</u> soils and landforms. Cartographic problems need to be resolved, as do symbolism and the production of generic, interpretive maps. Perhaps the development of conceptual models will aid in resolving the differing philosophical approaches that guide the way various professional groups view and record the environment. Finally, all of us must find ways to transfer the accumulated knowledge to those for whom all this work is undertaken in the first place, the resource manager. His operational needs must be satisfied if any of your findings and reasoning are going to improve the ecological management of wildlife populations, whether that results in their protection, preservation, or use. That then is the challenge to which this second Land/Wildlife Workshop of the C.C.E.L.C. is dedicated.

QUELS SONT LES AVANTAGES ET LES INCONVÉNIENTS D'UNE MÉTHODE INTÉGRÉE ET ÉCOLOGIQUE POUR L'INVENTAIRE DES HABITATS FAUNIQUES?

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On m'a demandé d'être provocateur dans mon allocution, et j'aimerais commencer par changer le titre du sujet qui m'a été confié comme suit:

> "Pourquoi les biologistes de la faune semblent avoir des difficultés à percevoir les avantages qu'un gestionnaire des ressources extrapole d'un système intégré et multidisciplinaire de classification des terres?"

Je vais tenter de répondre à cette nouvelle question en me servant de certaines des opinions que j'ai formées au cours des 25 années passées en association avec des biologistes de la faune. Je suis maintenant persuadé que la base des difficultés énoncées repose principalement sur la façon dont les diverses universités enseignent la biologie, comme si c'était une discipline plus ou moins à part des autres qui, pour diverses bonnes raisons, ont été forcées de s'associer il y a des années. Je ne veux pas dire qu'il n'existe pas de coopération et je ne veux pas laisser croire que vous ne connaissez pas les principes écologiques généralement acceptés par les autres disciplines biologiques et physiques. Ce que je veux dire, c'est que, au cours de vos études, vous n'avez pas été tenus d'intégrer vos découvertes à celles des scientifiques des sciences de la terre et de la végétation en vue de parvenir à des résultats avantageux pour tous. Je tiens à préciser, toutefois, que les excellents travaux de nombreux biologistes de la faune du passé et du présent se passent de commentaires et serviront de jalons importants pour le monde scientifique pendant encore de nombreuses années. Je ne prétends pas avoir le droit ou les connaissances nécessaires pour mettre en doute leur valeur. Cependant, pour des raisons qui ne m'apparaissent pas évidentes, vous ne semblez pas avoir réagi avec votre vigueur habituelle aux changements subtils qui se produisent actuellement dans l'esprit des utilisateurs des données que vous produisez lorsqu'il s'agit de problèmes environnementaux. La mise en place et l'acceptation par les gestionnaires des ressources des techniques de classification que nous appelons couramment CET n'ont pas été prises en compte même par certains des meilleurs biologistes de la faune. D'autres, qui ont pris note en passant des besoins changeants du monde réel, ont souvent rejeté les nouvelles méthodes innovatrices de classification de la faune faisant partie intégrante de la gestion des paysages, des sols, de la végétation, etc. comme s'il s'agissait d'une absurdité, pire encore, d'une façon grossière de troubler les éléments d'une science pure. J'admets que les traditions bien établies sont difficiles à changer, mais dans le cas de votre profession, dix années (de 1965 à 1975) ont été pratiquement perdues parce que, pendant ce temps, vous avez adopté une position de défense qui s'est avérée coûteuse pour vous.

Vous devriez maintenant vous demander pourquoi les gestionnaires des ressources utilisent cette nouvelle façon d'envisager le monde. Selon moi, ils considèrent que les résultats de la CET conviennent mieux à leur travail et à leurs besoins gestionnels que les rapports souvent ésotériques des biologistes de la faune. De par son caractère globaliste, la CET augmente les chances qu'a un gestionnaire de reconnaître les relations entre des facteurs passablement différents. Ainsi, il est mieux en mesure de trouver des possibilités et des solutions pour une gestion écologique davantage judicieuse. Veuillez noter que j'utilise le terme "judicieux" dans le sens d'une prise en compte intégrée et plurivalente d'un problème ou d'une ressource. Si des compromis s'avèrent nécessaires, il est possible de les reconnaître et de les justifier plus rapidement et mieux que par le passé. Les questions relatives à la faune sont les plus importantes pour vous, mais les gestionnaires des ressources, étant donné leurs fonctions, doivent prendre en considération tous les points. De plus, les techniques de cartographie de la CET obligent un groupe de scientifiques qui travaillent dans le cadre d'un système, avant même la réalisation des travaux sur le terrain, à parvenir à un concensus sur les paramètres philosophiques, méthodologiques et technologiques qui orienteront leurs efforts collectifs. La nécessité d'élaborer des légendes complètes pour chaque

écosite distinct avant que chaque polygone ne puisse être délimité est peut-être l'aspect le plus excitant de la CET. Il faut faire des compromis pour des questions vivement débattues chères à chacun d'entre vous. Néanmoins, il s'agit de la clé de voute de la connaissance pour les utilisateurs qui vivent et travaillent dans un monde de compromis politiques, sociaux, économiques et gestionnels. Pour eux, les détails scientifiques ne sont pas aussi importants que les façons de fusionner, aussi rationnellement que possible, les demandes de groupes d'intérêt quelquefois bruyants. Je ne suis absolument pas en faveur d'une diminution de la rigueur des documents issus de vos travaux, mais j'aimerais que vous compreniez les contraintes plutôt spéciales auxquelles doivent se plier les gestionnaires des ressources. Vos besoins personnels, les besoins à long terme de la biologie de la faune et les besoins immédiats des gestionnaires sont mieux servis si l'on admet que les meilleures conclusions des recherches peuvent n'aboutir à rien pour les personnes qui doivent faire face aux grands problèmes concernant une organisation ou la société dans son ensemble. Je sais que des centaines de traités qui garnissent les tablettes des bibliothèques de Parcs Canada n'ont absolument aucune incidence sur la façon dont la faune est gérée aujourd'hui, même si ces travaux ont donné des titres universitaires et apporté une réputation à leurs auteurs. Je frissonne en pensant au gaspillage des connaissances et à la perte ou à la mauvaise utilisation, suivant le cas, des faits nécessaires pour commencer à comprendre le monde complexe dans lequel nous vivons. Et pour compliquer les choses, certains scientifiques ont, par frustration je suppose, tenté d'usurper les prérogatives des gestionnaires. Nous sommes tous conscients des résultats de telles menées inutiles. Les scientifiques doivent rester des scientifiques. Ils doivent continuer à trouver des réponses aux questions soulevées, mais ils doivent également laisser le gestionnaire jouer son rôle, peu importe dans quelle mesure cela peut sembler désagréable à certains d'entre vous. De plus, il est possible pour des membres de votre discipline de se joindre au groupe des gestionnaires. Je suis persuadé que chacun d'entre nous, compte tenu de ses fonctions, peut servir l'humanité, et dans le cadre du présent atelier, contribuer au bien-être de la faune en trouvant des façons de coopérer plus efficacement. La CET est l'un des moyens qui s'offrent à nous pour réaliser ce but difficile à atteindre. Je suis persuadé que, une fois nos forces respectives mieux intégrées, nous ferons plus souvent appel à vous qu'actuellement, pour faire des recherches sur les aspects détaillés de la biologie de la faune et de la gestion de la faune, que vous ne pourriez le croire possible actuellement. Ces détails sont en effet nécessaires pour que les gestionnaires des écosystèmes assument leurs tâches avec succès aux yeux des scientifiques et du public qu'ils sont payés pour servir. Mais tout d'abord, vous devez convaincre les gestionnaires que les efforts spécifiques que vous déployez dans votre respectable discipline ne sont pas isolés mais font plutôt partie intégrante d'un grand ensemble auquel ils doivent s'intéresser. Les scientifiques des sciences de la terre, les biologistes de la végétation et les spécialistes de la cartographie et du traitement électronique des données sont en passe de réaliser cet objectif. Je ne suis pas assez naîf pour penser que cela peut se faire facilement ou rapidement, mais j'ai le plaisir de connaître certains de vos collègues qui, au cours des cinq dernières années, ont fait des efforts remarquables pour surmonter des difficultés que, vous aussi, avez pu rencontrer. Leurs efforts me font croire que les besoins très spéciaux des biologistes de la faune peuvent être satisfaits dans le cadre de milieux de travail intégrés multidisciplinaires. Je pense également que les difficultés actuellement perçues face à la CET disparaîtront lorsque vous occuperez les places qui vous reviennent au sein des équipes de classification écologique du territoire qui travaillent sur le terrain. Les avantages de cette méthode vous paraîtront tellement évidents que les deux sujets de discussion que j'ai soulevés tout à l'heure vous paraîtront avoir un caractère purement spéculatif.

Comment faire pour atteindre un tel résultat? Tout d'abord, les préférences personnelles et les excentricités doivent être mises de côté pour le bien de tous. De nouvelles normes de travail en groupe doivent être établies compte tenu des exigences de la méthode écologique intégrée; et, point le plus important, les voies de communication doivent être dégagées pour que nous puissions un jour convenir que ce que vous appelez habitat faunique est l'équivalent de ce que je nomme association végétale et que les deux existent naturellement, sous une certaine forme écologique, dans ce qu'un autre désigne sous le nom de sols et de paysages. Il faut résoudre les problèmes de cartographie ainsi que le symbolisme et la production de cartes d'interprétation génériques. L'élaboration de modèles conceptuels aidera peut-être à réunir les différentes méthodes qui orientent la façon dont les divers professionnels considèrent l'environnement et recueillent des données à son sujet. Finalement, nous devons tous trouver des moyens de communiquer les connaissances acquises à ceux pour qui tout ce travail est

accompli, c'est-à-dire les gestionnaires des ressources. Il faut satisfaire à leurs besoins opérationnels pour que vos conclusions et raisonnements améliorent la gestion écologique des populations fauniques, quels que soient les buts visés, c'est-à-dire la protection, la conservation ou l'utilisation. C'est le défi qu'il faut relever au cours de ce deuxième atelier Terre/Faune du Comité canadien de la classification écologique du territoire.

A WETLAND CLASSIFICATION SYSTEM THAT JUST MIGHT WORK!

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ABSTRACT

In 1978, a committee was formed by the B.C. Wetland Working Group to write a report on interior (Cariboo Region) wetlands. The report discussed problems involving user requirements of wetlands and proposed the basis for a wetland classification system.

Two well respected consultants were hired to develop a wetland classification system for the Cariboo Region using the recommendations and guidelines of the regional committee.

The classification system has been field tested, accepted by resource agencies in the Cariboo Region and published in the "Preliminary Wetland Managers Manual - Cariboo Resource Management Region."

The classification system is simple to understand, easy to use and based on an ecological classification system that is not biased towards any one use.

The paper discusses the classification system and how it evolved.

INTRODUCTION

The Cariboo Region, in the interior of British Columbia, is the only place I know of in Canada where a Wetland classification system has been developed based on management needs and designed with the help of people responsible for making the management decisions.

"Wetlands" are a significant feature of the Cariboo landscape and are subject to a wide range of use demands. Resource managers have long recognized the need for a guide that would assist them in classifying wetlands and reaching fair and rational decisions on their use.

The classification system I am going to discuss has been compiled for use within the Cariboo Regional Resource Management Region, although hopefully, as information becomes available, it can be expanded and modified to include other geographical regions in the province.

The entire classification process developed as a "team" effort involving interested agencies responsible for use and management of these wetlands.

The wetland classification is intended to be simple to understand, yet technical enough to accommodate the major integrated decision-making needs within the Region.

The following paper explains how the wetland classification system evolved and briefly describes the concepts and main components of the classification system. Figure 1 shows boundaries of the Cariboo Region and its relationship to the Province of British Columbia.

FIGURE 1 Cariboo Resource Management Region Location

HISTORY

For years, many of us in the Cariboo Region had been concerned about wetland management, however, we were fumbling around without any positive direction. Managing wetlands is sometimes like being the bottom half of a double boiler - you can get all steamed up and still not know what's cooking. A Regional committee was formed in 1975 to "study meadows". This committee had a very short life span and accomplished nothing.

In January 1978, the B.C. Wetland Working Group (a sub-group of the Vegetation Functional Sub-committee of the B.C. Land Resource Steering Committee) appointed sub-committees to review regional wetland problems throughout the province. Six sub-groups were formed with the group from the Cariboo being known as the Boreal, Cariboo sub-group. Because of my past involvement with Wetlands in our Region, I was asked to be chairman of this committee.

Participating members of the Boreal, Cariboo sub-group were:

Land Management Branch

Range Division
B.C. Forest Service

B.C. Ministry of Agriculture

Water Rights Branch

Ducks Unlimited

B.C. Fish & Wildlife Branch

B.C. Forest Service

The original purpose of the sub-group was to prepare a report for the provincial Wetland Working Group that included the following objectives for Cariboo wetlands.

1. To identify specific user requirements.
2. To identify kinds of users, nature of problems and conflicts currently being experienced.
3. To identify level of precision required, in terms of scale of mapping, scale of data gathering, precision of data, etc.
4. Requirements of the classification scheme imposed by the users demands; what features have to be included, what are the significant breaks or points of deviation, etc.
5. To investigate possible adjustments to regional boundaries and factors of importance to definition.
6. Priorization of work in specific areas.

In addition to discussing the above objectives the Boreal, Cariboo sub-group decided to make recommendations that were more specific to wetlands of the Cariboo Region.

RECOMMENDATIONS FOR WORK TO BE DONE ON CARIBOO WETLANDS

A wetland classification system is needed to aid managers in making decisions concerning alienation and use of Cariboo wetlands.

1. The wetland classification should be based on an ecological classification system that is not biased towards any one use, but rather classifies according to soils, vegetation and climate.
2. The sub-group recommend the Regional Managers develop a mechanism for direct liaison regarding initiation, review and analysis of wetland classification work done in the Cariboo. The purpose is to keep agency personnel in the region aware of current studies and develop communication channels for possible input and consultation.
3. After the classification is completed, the next step is to have resource specific evaluations by individual agencies upon which management options can be based.
4. The classification must be simple to understand and easy to use.

RESPONSIBILITY FOR WETLANDS

Wetlands of the Cariboo Region may be basically categorized in cultural terms as (A) Crown-granted (private land), (B) Crown-land administered under the Land Act (leases, etc.) and (C) vacant Crown Land.

In the Province of British Columbia, surface water is held in right of the Crown and managed under the Water Act. Contrasting with the jurisdictional areas of land classification and administration, the Water Act controls the uses and presence of water on all land. The management of the Water Resource is the responsibility of the Water Rights Branch; however, other interested Government agencies have a statutory opportunity for input into the decision making process.

USERS OF CARIBOO WETLANDS

The "users" of wetlands are of two types:

users by intent and users by coincidence. Users by intent may or may not require modifications to enhance natural values for their purposes. All users affect wetlands in some way and to varying degrees.

The role of resource managers responsible for wetlands is to decide:

1. which use or uses are most suitable for each wetland, on
   a) a site-specific basis, and
   b) a regional basis;
2. the kinds and extent of modifications allowable, if any, to enhance those uses; and
3. the permissible intensity of use.

To be able to make such decisions, managers must know:

1. the nature of the wetlands in question (details of descriptive parameters for soil, vegetation, water, etc.; or a classification system that incorporates those details);
2. the nature of the various potential uses and their effects on wetlands when practiced at varying levels of intensity; and
3. the regional significance of the various potential wetland uses on the basis of socio-economic and total environmental considerations.

WHERE TO START ON A CLASSIFICATION SYSTEM

A number of options exist when establishing artificial boundaries around groups of wetlands. Boundaries based on use, topography, elevation, etc. are all possibilities. However, after discussing the many options, the sub-group considered the bio-geophysical zones and sub-zones in the Cariboo as a starting point for wetland classification.

Five zones are recognized in the Cariboo region which have distinctive types of macro-climate and thus distinctive vegetation and soils. These zones are Alpine Tundra, Engelmann spruce-sub-alpine fir, sub-boreal spruce, Interior Western Hemlock and the Interior Douglas fir.

WHO PAYS THE BILLS

After our local wetland committee had determined the type of information we needed to make proper decisions on use, management and alienation of wetlands in our region, it was obvious we did not have the time or money needed to actually develop the classification system.

Art Benson and Norm Sprout of the Resource Analysis Branch (now called Terrestrial Studies Branch), Ministry of Environment in Victoria, came to our rescue. The Resource Analysis Branch provided contract money to hire two well respected consultants to develop the classification system following the recommendations our committee had proposed.

G.G. Runka and Dr. T. Lewis prepared the first rough draft of the Wetland Classification system. During the summer of 1980, this preliminary system was field tested in the Cariboo Region. The field testing was closely monitored by the regional wetland committee. Changes and modifications were made to the classification system and the "Preliminary Wetland Managers Manual - Cariboo Resource Management Region" was printed in May 1981.

The following portion of this paper discusses the concepts and use of the classification section of that manual.

HOW TO USE THE MANUAL

The manual is divided into two main sections: the first deals with classification of wetlands and the second, with use and management. The classification is presented in order, from the most generalized level of classification to the most specific.

The final section of the manual includes a Wetland Assessment Data Form for Managers and suggestions for a possible approach to resolving inter-resource conflicts and promoting integrated wetland use and management. A glossary is also included in the manual.

Both the classification and use interpretations are preliminary.

DEFINITION OF WETLANDS

There are nearly as many definitions of wetlands as people who have written of them. While a single definition acceptable to all remains elusive, it is felt the following is most suited to the Cariboo Resource Management Region.

"WETLANDS ARE LANDS THAT ARE WET ENOUGH OR INUNDATED FREQUENTLY ENOUGH TO DEVELOP AND SUPPORT A DISTINCTIVE NATURAL VEGETATIVE COVER THAT IS IN STRONG CONTRAST TO THE ADJACENT MATRIX OF BETTER DRAINED LANDS."

The definition also encompasses lands in the Cariboo-Chilcotin that are rarely inundated but saturated for just long enough to develop a distinctive vegetative cover unlike adjacent freely drained uplands - the meadows and shrub carrs. Since the period(s) of saturation is (are) too short to be reflected in the soil, these wetlands fall outside of the National definition by virtue of the lack of hydric soil.

The suggested definition excludes poorly drained mineral soils that support closed forests having a similar character to adjacent freely drained upland sites.

CLASSIFICATION OF WETLANDS

CONCEPTS

The Wetland Classification is built on the following concepts and principles:

1. that the most useful grouping of wetlands is hierarchical.
2. that, wherever possible, major classification groupings should be based upon diagnostic features that are visually discernible in the field situation and, preferably, on air photographs as interpretive expertise is increased.
3. that diagnostic features are characteristics integral to the wetland itself, not inherited from its location or its position in the landscape.
4. that inherited characteristics of a wetland and changes brought about by manipulation are indicated separately from the taxonomic classification, as modifiers.
5. that differentiating characteristics and the level at which they are used will vary with the kind of wetland being considered.
6. that the classification be open-ended to invite improvement and expansion as knowledge and experience increase, and that it be in a form that can be adapted to province-wide application.

THE WETLAND CLASSIFICATION

At present, this wetland classification comprises four levels:

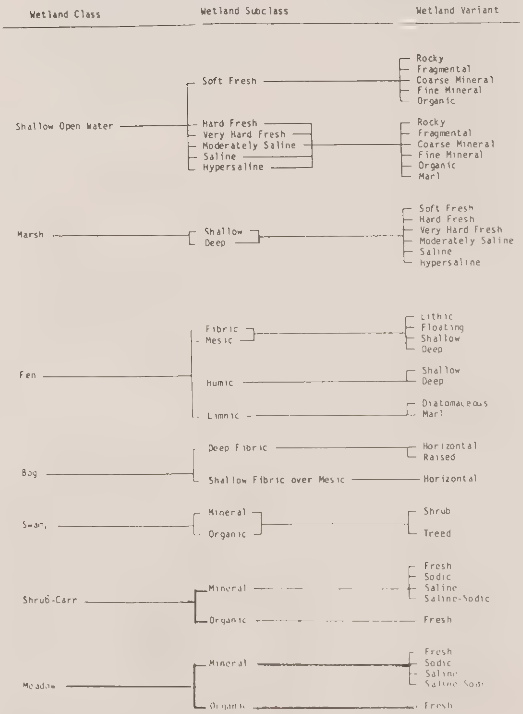
Wetland Class - the highest level of generalization, is a grouping of wetlands produced by, and reflecting, a specific hydrologic - chemical environment, and supporting a relatively narrow range of ecosystems, as indicated by broadly similar biotic communities. Wetland Classes are separated on the basis of diagnostic criteria, including substrate, water regime, water chemistry and broad vegetation groupings.

Wetland Subclass - the second highest level of generalization, is a subdivision of Wetland Classes, based upon finer divisions of either wetland substrate, water regime or water chemistry, depending upon the relevance of these factors to ecosystem function.

Wetland Variant - the third level of generalization, is a finer subdivision of Wetland Subclasses or a reflection of additional criteria relevant to either ecosystem function or genesis.

Wetland Plant Association - the lowest level of classification envisioned at this time, is a division of Wetland Variants on the basis of relatively stable, self-perpetuating wetland plant associations specific to a biogeoclimatic subzone.

Figure 2. WETLAND CLASSES, SUBCLASSES AND VARIANTS THAT ARE ANTICIPATED TO OCCUR IN THE CARIBOO RESOURCE MANAGEMENT REGION



WETLAND CLASSES

The definition of each Class is essentially in two parts: the following statements are con-

sidered the diagnostic statements defining the Wetland Class. The classification also expands upon the diagnostic statement by providing descriptive information to further aid in identifying the Wetland Class. However, this descriptive information has not been included.

Shallow Open Water -is a wetland that is comprised of permanent shallow standing water and that lacks extensive emergent plant cover.

Marsh - Marshes are wetlands that are permanently or seasonally inundated and that support an extensive cover of emergent, non-woody vegetation rooting in mineral-rich substrate.

Fens - Fens are wetlands comprised of in-situ accumulations of well to poorly decomposed non-Sphagnic peats.

Bogs - Bogs are wetlands comprised of in-situ accumulations of poorly to moderately decomposed Sphagnum-derived peats.

Swamps - Swamps are tree or tall shrub-dominated wetlands that are characterized by periodic flooding and nearly permanent subsurface water flow through various mixtures of mineral sediments and organic materials.

Shrub-Carrs - Shrub-Carrs are low shrub-dominated wetlands developed on mineral materials that are periodically saturated but rarely inundated.

Meadows - Meadows are herbaceous wetlands developed on mineral materials that are periodically saturated but rarely inundated.

WETLAND SUBCLASSES AND VARIANTS

Once a wetland has been classified at the Class level, attempts are made to further classify at the Subclass and, if possible, at the Variant level. Except for the Shallow Open Water Class, identification at the Subclass level should be possible through close field observation. At the Variant level of classification, some laboratory analysis may be necessary, which may not always be immediately available to the manager. It should be noted, however, that identification to this level of detail is not essential to use of the rest of the manual, as at this time, most of the use interpretations are made at the Subclass, if not the Class, level.

Shallow Open Water

At the SUBCLASS level, Shallow Open Water wetlands have been subdivided on the basis of water chemistry, as a broad indication of wetland productivity and plant and animal ecology. The nature of bottom materials is the basis for division at the VARIANT level.

Marshes

At the SUBCLASS level, marshes are subdivided on the basis of the depth and relative permanence of surface water and the nature of the substrate; at the VARIANT level, according to water chemistry, as a broad indication of wetland productivity and plant and animal ecology.

Fens

At the SUBCLASS level, fens are separated on the basis of the nature of the peat materials; at the VARIANT level, on the basis of depth of peat, presence of water at depth or nature of the limnic layer, if present. The degree of decomposition in fens is correlated to a considerable degree with elevation. Humic fens are found mostly at lower, warmer elevations, febric fens in the higher colder elevations, and Mesic fens at intermediate elevations.

Bogs

At the SUBCLASS level, bogs are separated on the basis of the nature and depth of peat materials; at the VARIANT level, on the basis of surface form.

Swamps

At the SUBCLASS level, swamps are separated in accordance with the nature of soil substrate; at the VARIANT level, according to vegetation.

Shrub-Carrs

At the SUBCLASS level, Shrub-Carrs are subdivided according to the nature of the soil substrate; at the VARIANT level, according to wetland chemistry.

Meadows

At the SUBCLASS level, meadows are subdivided according to the nature of the soil material; at the VARIANT level, according to wetland chemistry.

WETLAND PLANT ASSOCIATIONS

Ultimately, each wetland individual should be characterized as supporting a specific Plant

Association, which is anticipated as a reflection of wetland character and biogeoclimatic subzone. At present, only a few wetlands can be characterized to this level of detail.

WETLAND MODIFIERS

The wetland individual is then placed within an overall landscape perspective by the use of one or more MODIFIERS, which are not part of the taxonomic classification, per se, but which provide additional information on a) physical form, b) position in relation to other wetland individuals, c) hydrotopographic character within the landscape or watershed and d) use.

Form Modifier

A form modifier is intended to accommodate those wetland form features that are not considered a direct function of wetland genesis or diagnostic of wetland character. Where form is an indicator of wetland genesis, such as the "domed" (raised) form of some Bogs, this has been incorporated within the taxonomic classification at the Variant level. If no form modifier is applied to a wetland individual, form is assumed horizontal at the macro scale, with level microtopography. The classification presently has the following form modifiers:

1. sloped - an inclined wetland.
2. ribbed (including reticulate) - a wetland having low linear ridges or strings of organic materials. In reticulate or net patterns these ridges intersect.
3. hummocky - a wetland having an irregular mounded surface resulting from frost-heaving.
4. channelled - a wetland cut by small permanent or temporary flood channels.
5. pond - a wetland which has interspersed small ponds of water; may be inclusions of Shallow Open Water in another wetland class.

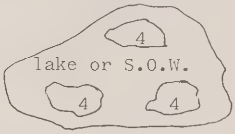
Wetland Position Modifier

Wetland position indicates relative location with respect to other wetland components, a factor that can have implications upon management options.

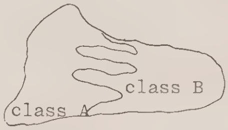
1. central
2. intermediate
3. peripheral

3a. peripheral/shore

4. island



5. fingered
6. other (specify)



Wetland Hydrotopographic Character Modifier

Hydrotopographic character of a wetland reflects local physiographic setting or topographic position and implies the character of the watershed from which the wetland receives either surface or ground waters. Hydrotopographic character is considered the most important modifier, as it determines, to a large extent, the nature of wetland genesis. It indicates, in a general way, management opportunities for flow control, either drainage or flooding, and the potential path of pollutants. Hydrotopographic character may be inferred from aerial photographs or from topographic maps of a suitable scale.

Six hydrotopographic characters are relevant to wetland formation: palustrine, lacustrine, riverine, seepage slope, estuarine and marine. All but estuarine and marine occur in the Cariboo region.

USE MODIFICATION

Where the wetland ecosystem has been altered as a result of past or current land use practices, the type of modification is recorded. Modifications such as cultivation, irrigation, beaver, etc. can have an effect on management decisions involving wetlands.

In summary, the characterization of a wetland is considered a combination of taxonomic

classification and modifiers. Ideally, if adequate research and inventory were available, a complete characterization of a wetland individual is therefore envisaged as follows:

SAMPLE: A Deep Mesic Fen with a Carex rostrata - Triglochin maritima plant association, of ribbed form in a central, closed basin palustrine position, and altered by water table control, hay cutting and grazing.

This type of characterization is more useful to managers than just calling the wetland a "bog hole".

WETLAND COMPLEX

In most instances, wetlands occur as a group of classes that form a wetland complex.

For instance, it is common to find a marsh adjacent to shallow open water, surrounded by a fen that has a small band of shrub-carr integrating into the upland. When an onsite inspection is done, a crude map or sketch of the wetland complex is made. Understanding the wetland complex and how it fits into the surrounding area gives the manager a good base on which to make management decisions.

The second half of the "Preliminary Wetland Managers Manual" proposes the beginning of a format concerned with use interpretation of the classification system. This would probably make a good topic for another paper, however, the length of this paper does not allow me to discuss the subject now.

SUMMARY

The wetland classification system was devised because of a need by resource managers to be able to "talk the same language" when dealing with wetlands. A committee of concerned managers was formed that decided what was needed and prepared the "ground rules" for a classification system. Two well respected consultants were hired to work on the project and prepared the "Preliminary Wetland Managers Manual". The classification system is simple, easy to use and is accepted by resource managers in the region. The next major step for resource managers is to integrate the classification system into the decision making process involving use and alienation of Cariboo wetlands.

ACKNOWLEDGEMENTS

In order to avoid endless repetition of references throughout this paper, I hereby acknowledge the references appended from which information was used freely.

I would also like to acknowledge the efforts of the "Cariboo Wetland Committee" for their large part in making this classification and manual a reality. The members of the committee are Bill Watt (B.C. Forest Service), Ed Hennan (Ducks Unlimited), Peter Fofonoff (Ministry of Agriculture), Chris Easthope (Range Branch, B.C. Forest Service), Fred Baxter (Land Management Branch).

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Boreal, Cariboo Wetlands - Status and needs Williams Lake, B.C. Unpubl. report.

Runka, G.G., Lewis, Dr. T. May 1981
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RÉSUMÉ

En 1978, le groupe de travail sur les terres humides de la C.-B. a formé un comité chargé de rédiger un rapport sur les terres humides de l'intérieur (région de Cariboo). Dans le document, on traite des problèmes touchant aux besoins des usagers des terres humides et on propose une assise pour un système de classification des terres humides.

On a engagé deux consultants reconnus pour élaborer un système de classification des terres humides, pour la région de Cariboo, au moyen des recommandations et des lignes directrices du comité régional.

Le système de classification a été essayé sur le terrain, accepté par les organismes chargés de la gestion des ressources de la région de Cariboo et publié dans "Preliminary Wetland Managers Manual - Cariboo Resource Management Region" (guide préliminaire à l'intention des gestionnaires des terres humides - gestion des ressources de la région de Cariboo).

Le système est simple à comprendre et à utiliser; il est fondé sur un système de classification écologique d'origine totalement désintéressée.

Le document traite du système de classification et de son évolution.

A BIOPHYSICAL ESTUARINE HABITAT MAPPING AND CLASSIFICATION SYSTEM FOR BRITISH COLUMBIA

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ABSTRACT

A biophysical mapping and classification system developed for describing estuarine habitats is summarized. The basis of this system is the habitat type comprised of zone and component. Zones represent position with respect to tidal inundation for example, subtidal, intertidal, backshore; while components represent biologically or physically discrete habitats which exist within zones. Several types of modifiers pertaining to substrate, vegetation, salinity and anthropogenic influence may be utilized to describe habitat types.

An example of a map is also provided.

RÉSUMÉ

La méthode de classification et de cartographie biophysique mise au point pour décrire les habitats estuariens est décrite brièvement. L'élément de base est le type d'habitat constitué de zones et de composantes. Les zones sont délimitées par rapport à l'inondation des marées, par exemple la zone infratidale, la zone intertidale et l'arrière-côte, tandis que les composantes sont des habitats particuliers du point de vue biologique ou physique qui existent au sein des diverses zones. Plusieurs types de facteurs modificateurs relatifs au substrat, à la végétation, à la salinité et à l'influence anthropique peuvent être employés pour décrire les types d'habitat.

Une carte est présentée à titre d'exemple.

INTRODUCTION

The British Columbia Estuarine Habitat Mapping and Classification System was developed during the past three years by members of the Terrestrial Studies Branch (TSB), Wildlife Unit, B.C. Ministry of Environment.

Several facts about British Columbia's coast and the fish and wildlife resource that it supports provided the rationale for development of this system. These are listed below.

1. Of the 10.8 million waterfowl of the Pacific Flyway (U.S. Fish and Wildlife Service, 1981) an estimated 5.4 million (50%) utilize coastal migratory routes. In addition, an estimated 1 million ducks and geese winter along B.C.'s coast (B.C. Ministry of Environment, 1981).

2. British Columbia's coast also supports a highly significant salmon industry. For example, in 1981 commercial fishermen harvested 74 530 metric tonnes of salmon having a landed value of $155,000,000 (pers. comm., Wm. Massey, Department of Fisheries and Oceans Canada).

3. One of the principal habitats utilized by those salmonids and waterfowl consists of biologically productive estuarine wetlands (tidal marshes, flats and shallows associated with river mouths) which make up only 2.3% of B.C.'s 27 000 km of coast line (Bjornhold and Clague, 1978).

4. Those wetlands furnish salmonids, waterfowl, and a variety of other organisms with food, resting areas and space, thus minimizing mortality and ensuring the perpetuation of healthy populations.

5. B.C.'s coast is the fastest developing area of the province - over 60% of the referrals handled by the B.C. Ministry of

Environment Assessment Branch involve proposals for the development of coastal sites, the majority of which affect estuaries (J. Secter, pers. comm.). Due to their relatively level backshores, easy access to tidewater, fertile soils and proximity to freshwater, estuarine areas are, and have historically been under great pressure for development (Lands Directorate, 1981).

Despite the importance of estuaries to the fish and wildlife resource and the obvious pressures from development, up until very recently attempts to inventory and map estuarine habitats had been limited to vegetative descriptions of vascular plant communities e.g., Forbes (1972); Yamanaka (1975); Moody (1978); Hunter et al. (1981); Dawe and White (1982) and Kennedy (1982). The disadvantages of this type of inventory and mapping were threefold. Firstly, those vegetative descriptions were usually botanically quite technical and thus difficult to interpret. Secondly, other components of habitats aside from vegetation and all non-vegetated habitats were generally ignored. Thirdly, because of their technical natures and narrow perspectives such attempts to map and classify estuaries failed to provide a common language enabling biologists, managers and planners to communicate and develop management and land-use interpretations.

As a result of this situation, the Terrestrial Studies Branch has developed a biophysical habitat oriented system for mapping and classifying estuaries.

During the process of developing this system, care has been taken to avoid the creation of new terminology. We have therefore borrowed extensively from other authors; notably RAB (1980); Chamberlin (1980); Howes and Owens (1980); and Runka and Lewis (1981). We are thankful to the individuals involved in those publications.

The Estuarine Habitat Mapping and Classification System manual is available from the Map Library, Assessment and Planning Division, B.C. Ministry of Environment, Parliament Buildings, Victoria, B.C., V8V 1X5, (604) 387-6995.

THE INVENTORY PROCESS

The Estuarine Habitat Mapping and Classification System facilitates collection, organization and presentation of information describing biophysical characteristics of estuaries considered important to fish and wildlife species. The fundamental unit within the classification system is the habitat type. Not to be confused with those of Daubenmire, estuarine habitat types are based on tidal zonation and biophysical habitat components modified by appropriate substrate, vegetation, salinity and anthropogenic descriptors. Because habitat modifiers cannot always be assessed remotely, considerable field work is required in addition to airphoto interpretation.

Data Collection

Prior to initiation of data collection a study area boundary is defined and the most appropriate scale of presentation determined. The usual mapping scale is 1:5000 - 1:10 000. Every effort should be made to ensure that the final product will serve the needs of a broad audience and not solely those of the requestor. The data collection process consists of two phases: (i) pretyping of aerial photos and review of existing information; and (ii) field surveys.

Pretyping and Review of Existing Information- Since 1975, low tide, mid summer, large scale (1:4800 - 1:12 000) colour aerial photographs have been taken of most of the major estuaries in the province by the Surveys and Mapping Branch, BCMOE. Prior to entering the field, those and any additional aerial photographs along with marine charts and other pertinent resource mapping are used to pretype the study area. Vegetative and physical boundaries are established during pretyping.

Because no large-scale terrain mapping exists for coastal areas/estuaries, whenever possible, a fluvial geomorphologist is consulted during the pretyping phase to confirm physical boundaries that are established.

The importance of pretyping cannot be overstated. Pretyping provides relevant information to study area logistics such as access, boat and time requirements. Pretyping also aids in sample site selection and identification of problem areas which will require special attention.

Review of historical information involves gathering and examining airphotos, reports and inventory data for the study area. Examining aerial photography history permits an assessment of the relative stability of the area. This procedure also facilitates the investigation of the influence of human-

caused impacts on the estuary and may assist in explaining conditions that are difficult to interpret in the field.

Agencies to be contacted when searching for reports and historical information include: the Regional Fish and Wildlife Branch office; Marine Resources Branch; Aquatic Studies Branch; Terrestrial Studies Branch; Department of Fisheries and Oceans; Lands Directorate, Pacific Region; the Canadian Wildlife Service; and where appropriate, Public Works Canada. Land statuting should be checked through the Land Management Branch, Ministry of Lands, Parks and Housing and land owners are consulted prior to undertaking fieldwork.

Estuary Sampling

Field work is conducted during the lowest tides of July and August. Ideally sampling activities should take place as close as possible to the dates on the aerial photographs being used for the survey, but late enough in the growing season for grasses to have flowered.

Field Data Collection

Sample sites are established by pretyping large scale colour and, if possible, false colour IR airphotos. General information (date, location and general ecological data) is recorded on standard TSB "Site Forms". Special care is taken to locate and record the X and Y coordinates of each sample site to facilitate subsequent site relocation. Procedures for recording "Site" data are provided in Data Entry Procedures for Describing Ecosystems in the Field (Sondheim et al., 1982).

If a sample site supports vascular plants or macrophytic algae, a TSB Vegetation Form is completed. Standard plot size is 4 x 4 m^2 and five sample plots per homogeneous pretyped habitat are completed.

Procedures for recording vegetation data are provided in Sondheim et al. (1982).

A "TSB" Wildlife Form is also completed for each estuary. An example of that form and procedures for recording wildlife data are provided in Pendergast et al., 1982. All Terrestrial Studies Branch data forms are designed for computer entry without intermediate transcription.

While in the field, special attention is paid to the location of habitat boundaries (boundaries indicating physical or vegetative changes of significance to wildlife or fish). Intertidal/Backshore and Intertidal/Subtidal boundaries may sometimes be particularly difficult to identify and may sometimes require special attention.

Special attention is also given to the location and significance of features such as culverts, floodgates, outfalls, intakes, dykes and other anthropogenic features that may influence habitats.

DATA PRESENTATION

Data is normally presented in the form of a map and descriptive or interpretive legend (see enclosed Tashish Estuarine Habitat Inventory map). Estuarine habitat maps are available from the Map Library, Assessment and Planning Division.

Mapping and Map Symbols

The normal scales of presentation of Estuarine Habitat Maps are 1:5000 and 1:10 000. Habitat zones and components and modifiers that are mapped are presented in boxes 3 and 4 of the enclosed map. Zones represent areas which differ as a result of tidal influence while components (zonal subdivisions) are generally biophysically homogeneous areas considered to represent different habitats.

Zone and component comprise the numerator of map symbols and indicate habitat types. These may be affected by various "habitat modifiers" such as substrates, vegetation, salinity, and anthropogenic features which occur in the denominator of each symbol. On site symbols (see box 6 enclosed map) are used to indicate selected anthropogenic features. Care has been taken to ensure that such symbols are as standardized as possible.

In order to ensure consistency between mappers, a list of 24 mapping conventions has been created. Those are presented in Hunter et al. (1982).

Descriptive and Interpretive Legends

Habitat type information is presented in one of two legend formats which accompany each map. Descriptive legends consist of a characterization of each habitat type with a discrete numerator. "Ifl" (intertidal flats) for example, is a discrete map symbol numerator which could have several different denominators on the same map reflecting differences in substrate, salinity, presence or absence of nonvascular plants and various

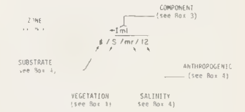
TAHSISH ESTUARINE HABITAT INVENTORY

LEGEND

1 Explanatory Notes

The estuarine habitat mapping and classification system is designed to delineate habitat types and describe them as a function of substrate, vegetation, salinity and anthropogenic influences. Information is derived from interpretation of recent large scale colour air photos and ground truthing, and is supplemented by information derived from historical reports and air photos. Specific descriptions of habitat types are presented in Box 5 along with area summaries expressed in hectares and as percentages. Because of the dynamic nature of estuarine systems maps may require updating. Users should therefore refer to the date of mapping shown in Box 8. Users are encouraged to consult APD Technical Paper, Estuarine Habitat Mapping and Classification System Manual 1982, for descriptions of inventory and mapping methods and terminology utilized in the classification system.

2. Example of Map Unit



3 Habitat Type

ZONE	SYMBOL	COMPONENT	SYMBOL
SUBTIDAL	S	[illegible]	re
		deep subtidal	sd
		shallow subtidal	ss
INTERTIDAL	I	bar	ba
		berm/beach face	bf
		back channel	cb
		river channel	cr
		side channel	cs
		tide channel	ct
		flat	fl
		marsh	ma
		high marsh	mh
		intermediate marsh	mi
		low marsh	ml
		platform	pl
		reef	re
BACKSHORE	B	[illegible]	ba
		[illegible]	bo
		[illegible]	cb
		river channel	cr
		side channel	cs
		fen	fe
		forest	fo
		marsh	ma
		meadow	me
		permanent pond	pp
		semi-permanent pond	ps
		temporary pond	pt
		shrub	sh
		storm ridge	sr
		swamp	sw

4. Habitat Modifier

TYPE	SYMBOL	TYPE	SYMBOL
SUBSTRATES		SALINITY	
clay	c	brackish	br
silt	s	fresh	fr
fines	f	marine	mr
sand	s		
small pebble	p		
large pebble	g		
cobble	k		
boulders	b		
bedrock	r		
organic	o		
shell	m		
VEGETATION		ANTHROPOGENIC	
coniferous	C	log handling	1
deciduous	D	agriculture	2
mixed	M	landfill	3
non-vascular	N	dyke, seawall, causeway	4
submerged vascular	S	culvert	5
		floodgate	6
		outfall	7
		pollution	8
		intake	9
		residential	10
		industrial	11
		marina	12
		port facility	13
		substrate removal	14
		jetty, groin, weir	15
		log debris	16
		logged	17

5. Descriptions of Habitat Types

SYMBOL	DESCRIPTION	AREA (ha)	% TOTAL
	SUBTIDAL ZONE	35.9	24.8
Sre	This habitat type includes bedrock outcrops located within the subtidal zone. Supratidal portions are sparsely vegetated.	6.1	4.2
Ssd	Subtidal habitats with bottom depths greater than 10 metres. Less saline areas are found in the surface water layers. These areas support a variety of groundfish as well as providing habitat for salmonid staging. Bird use includes feeding and loafing by diving birds and loafing by dabbling ducks and gulls. Harbour seals utilize subtidal habitats for feeding.	29.7	20.5
Ss[illegible]	Included in this habitat type are subtidal areas with depths less than 10 metres. Within this habitat type, brackish water overlies waters of higher salinity. Fish and wildlife use of this habitat type is similar to deep subtidal habitats except for higher utilization by diving ducks for feeding.	0.4	[illegible].3
	INTERTIDAL ZONE	91.4	64.4
Iba	Formed along the bends of the river channels, these active, depositional areas are generally composed of large pebbles with some sand and cobbles. Sediment transport and deposition patterns are dominated by fluvial factors with some modifications by marine processes. Filamentous green algae (Enteromorpha intestinalis) and rockweed (Fucus sp.) occur on bars near the mouth of the estuary. Stable bars commonly have minor amounts of vascular vegetation. Within the upper portion of the estuary these areas may serve as spawning habitat for pink and chum salmon. Bars serve as loafing sites for wintering and migrating waterfowl and shorebirds. Bald eagles and American black bear utilize river bars extensively during the fall salmon runs. Other mammals utilizing the[illegible] habitat [illegible] Bars [illegible] near the ocean may be utilized as harbour seal haulouts.	26.3	18.5
Ibf	This upper intertidal habitat type is characterized by pebble substrates. These marine dominated areas are generally unvegetated or sparsely vegetated by annual plants. Bird use is limited to feeding shorebirds and songbirds and loafing dabbling ducks, Canada geese and wintering seaducks. American mink, river otter and raccoon may make extensive use of these areas.	0.3	0.2
Icr	This habitat includes mainstem areas of the Tahsish River which are influenced by saltwater penetration and regular and seasonal fluctuations due to tidal and fluvial influences respectively. Bed materials vary from pebble/cobble within the upper portions of the delta to pebble/sand in the lower portion of the delta. Filamentous green algae occur along channel edges. This habitat type is important for salmonid migration, spawning and rearing. Wintering and migrating diving ducks and wintering trumpeter swans utilize river channel habitats for feeding and loafing. Mammalian use includes river otter, American mink and raccoon.	8.8	6.1
Ics	Two side channels are present within the study area. One has cobble bed materials and runs along the western boundary of the study area. Filamentous green algae occur along its channel edges. The other channel is wetted only during high tides or high river flows and has a finer textured bed of sand and large pebbles. These channels function as important migration spawning and rearing areas for salmonid species. Dabbling waterfowl utilize these areas to a limited extent for feeding migration and wintering. Mammalian use is similar to river channel habitats.	5.1	3.5
Ict	This habitat type consists of a large channel at the mouth of the estuary and numerous small channels and diverticulations which drain the intertidal marshes and flats. Most of these dry at low tide. Bed materials vary from cobble and pebbles in the larger channel to finer textured materials within the smaller channels. Low marsh plants, particularly Lyngbye's sedge border the channels. This habitat type is extremely important as a nursery area for juvenile salmonids. Dabbling ducks, trumpeter swans and wading birds utilize tidal channels for feeding during migratory and winter periods. These areas are also utilized by mink, river otter and raccoon.	1.0	0.7

SYMBOL	DESCRIPTION	AREA (ha)	TOTAL
	INTERTIDAL ZONE (continued)		
Ifl	This habitat type is exposed only at low tides, and occurs adjacent to low marsh areas and intertidal bars. The flats are generally characterized by finer textures and lower gradients as compared to bars. Filamentous green algae, brown algae and to a lesser extent alkali grass are commonly present. Epibenthic diversity on the flats is low. This habitat type serves as a nursery area for juvenile salmonids and as a pre-spawning staging area. Other fish utilize flats for year-round foraging. Waterfowl use of intertidal flats includes feeding by migrating and wintering dabbling ducks, wintering trumpeter swans and migrating Canada geese. Shorebirds and waders also utilize flats for feeding. Migrating and wintering diving duck use may be extensive at high tide stages. Bald eagles and American black bear forage on flats for salmon carcasses during fall migration periods. Harbour seals may utilize specific areas as haulouts.	[illegible]	[illegible].3
Imh	This habitat type is located between backshore forest areas and lower marsh areas. It is characterized by silty organic substrates and the presence of numerous large tidal pools. The dominant plant species within this floristically diverse habitat type are red fescue and meadow barley in lower areas and dune wild rye grass in slightly higher areas. Other species usually occurring in this habitat are yarrow, springbank clover, and Pacific silverweed. The total percent vegetative cover averages 90%. High marshes provide spring forage for American black bear and important year round forage for Roosevelt elk and Columbia black-tailed deer. Waterfowl use of high marshes is limited to grazing by dabbling ducks, Canada geese and trumpeter swans. Other wildlife which utilize this habitat type include songbirds, small mammals, reptiles and amphibians. These areas are of less direct importance to salmonid rearing than lower marshes, however they are a major producer of detritus and source of nutrients for the estuary and adjacent marine areas.	2.[illegible]	[illegible].8
Imi	Occurring on organic silt substrates, this habitat type is less diverse than the adjacent high marsh. The dominant plant species are Arctic rush and sea-side arrow-grass. Pacific silverweed, Lyngbye's sedge and [illegible] use of this habitat type is similar to that of the adjacent high marshes. As well as being a major producer of detritus and source of nutrients, these areas and the tidal channels within them serve as important rearing areas for salmonid species when flooded.	4.[illegible]	[illegible].8
Iml	This habitat type is located adjacent to intertidal flats and bars and is drained by numerous tidal channels. The predominately silty sand substrates are colonized by two plant communities. A Lyngbye's sedge dominated community occurs along tidal channels at low elevations and a community dominated by tufted hair grass occupies slightly higher elevations away from the tidal channels. Vegetative cover averages 50%. These areas are important for salmonid rearing. Bird use includes feeding by wading birds, migrating dabblers and Canada geese and wintering trumpeter swans. Diving birds may feed in these areas at high tide stages. Utilization by small mammals, reptiles and amphibians is low.	0.[illegible]	[illegible].2
Ipl	This habitat type occurs within the marine portion of the study area and is characterized by bedrock substrates overlain by sand and large pebbles. Such areas are formed by erosional wave action. Wildlife use of these habitats is similar to beach face habitats.	0.[illegible]	[illegible].3
	BACKSHORE ZONE	15.[illegible]	[illegible].6
Bfo	Both coniferous and deciduous forests are found within the study area. Coniferous areas are dominated by Sitka spruce often associated with western hemlock. Salmonberry, red huckleberry and stink currant are common understory components. Deciduous forests have developed on recently deposited alluvium and are dominated by red alder. Forest habitats are utilized extensively year round by Columbia black-tailed deer and Roosevelt elk for cover and foraging. American black bear also forage within this habitat type and use by small mammals is extensive. Bird use includes nesting by cavity dwellers, passerines and raptors.	5.[illegible]	[illegible].6
	Total area of entire study area	145.0	100

6. Anthropogenic On Site Symbols

7. Sources of Further Information

Assessment and Planning Di[illegible]. Water Bird Data Base. Terrestrial Studies Branch, Ministry of Environment, Victoria, B.C.

[illegible] Tahsish-Kwois (draft). Ministry of Environment. Victoria, B.C.

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Marshall, D.E., M.J. Comfort, and E.W. Newton. [illegible] Catalogue of Salmon Streams and Spawning [illegible] Statistical Area 26. [illegible] Data Report, Fisheries and Aquatic Sciences No. 131. p. [illegible] 86.

8. Credits

Supervised by R.A. Hunter

Mapped by M.M. Wayne, A. Campbell

Field work by A. Campbell, L.E. Jones

Date of field work, June 1981

Photography used BCC116 118-129, BCC285 167-165, 180-183

Map drafted by Cartography, Terrestrial Studies Branch, March 1982

Base map prepared by Cartography, Terrestrial Studies Branch

1982 Edition

influences of anthropogenic features. The description of the "Ifl" habitat type would therefore indicate such variations for a given study area. Habitat type descriptions incorporate existing information with field data to provide as complete a description as possible. Backshore areas except where especially significant, are generally only briefly described.

Interpretive legends also describe habitat types and provide information on the value of individual habitat types to selected fish and wildlife species. Interpretive legends are generally structured to suit the needs of the requestor and may include detailed information on the effects of existing impacts or proposed developments on estuarine habitats. Rehabilitation and enhancement techniques for modified habitat types and disturbance sensitivity analysis may also be presented.

Area Determinations

Two figures appear opposite the heading for each habitat type described in a legend: one representing the total area in hectares occupied by the particular habitat type and another representing the percentage of the total study area that each comprises (see box 5 enclosed map).

Currently areas are determined by means of a Hewlett-Packard 9825A calculator with a 9864A digitizing table.

DATA MANAGEMENT AND ANALYSIS

As noted earlier, all site, soil, vegetation and wildlife data are collected on standardized computer compatible forms. Such data are entered into computerized data bases. Computer systems have or are being developed around those data bases using "Site Form" numbers as a common thread. Those systems provide the capability for standard analytical procedures.

Although at present, vegetation data cannot easily be combined with site and soil information for computerized analysis, a computer program package (COENOS) is available to assist in computerized grouping of vegetative data. Because the environmental constraints on vegetation in estuaries are so severe however, vegetative communities are generally quite discrete and data can easily be organized manually. In areas where vegetative patterns are more complex, computerized sorting packages are utilized.

Present development of a computerized system, the Coastal Resource Information System (CRIS), is under consideration. Such a system would be based on the physical (terrain) and biological attributes of coastal environments. Links would be established between this and existing site, soil, vegetation, wildlife and aquatics data bases.

RESEARCH NEEDS

The Estuarine Habitat Mapping and Classification System is still evolving, particularly in the area of interpretations. This stems from both a lack of knowledge in certain subject areas and difficulties in applying available knowledge. Identified research needs generally fall into two categories:

1) determination of the relative importance of specific habitat types to shellfish, fish, wildlife, and commercial plant species, and

2) identification of the physical characteristics that govern the distribution of faunal and floral components of habitats.

Increased knowledge in both areas is essential if those involved in coastal resource inventory are to improve the quality of interpretations regarding estuarine habitat for assessment, management and planning activities. The first step toward this "increased knowledge" must involve increased communication between agencies and individuals involved in coastal land-use activities so that data gaps and data needs can be identified.

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THE USE OF THE BIOPHYSICAL PROGRAM AND CAPABILITY CONCEPTS IN MAPPING UNGULATE HABITATS IN BRITISH COLUMBIA

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ABSTRACT

The biophysical system, used to classify land for ungulates in British Columbia, is discussed. The capability concept used in the biophysical program has its origin in the Canada Land Inventory program. Three main premises of the biophysical capability classification program are discussed as they relate to: the relationship of existing ungulate biomass to potential; limiting factors; and, predictability of various habitats. Example map products are also presented.

RÉSUMÉ

La méthode de classification biophysique employée pour classer les terres selon leur potentiel pour les ongulés en Colombie-Britannique est examinée. Le concept de "potentiel" utilisé dans le programme biophysique tire son origine de l'Inventaire des terres du Canada. Trois principes de base du programme de classification du potentiel biophysique sont considérés des points de vue suivants: rapport entre la biomasse existante d'ongulés et le potentiel; facteurs limitants; et prévisibilité de divers habitats. Des cartes obtenues sont également présentées à titre d'exemples.

INTRODUCTION

Since the implementation of the Canada Land Inventory (CLI) programme in 1965, British Columbia has had a wildlife inventory program that is based on the concept of capability. The first series of mapping projects was conducted at a scale of 1:126 720, covering the two-thirds of the province that was mentioned in the Agricultural Rehabilitation and Development Act (ARDA). Since the mid-1970's, subsequent to the completion of the CLI mapping program a new inventory program has been implemented. It usually has been used at a scale of 1:50 000, but it is also applicable at smaller scales, ie. 1:250 000.

Several position papers have been written on our programmes and while it is not necessary to recite the philosophies that they contain, they are listed below for reference purposes.

The fundamental philosophies and techniques of the biophysical land classification as it is applied in British Columbia were outlined by Walmsley (1976). He listed three objectives that underlie the biophysical classification scheme: (1) to differentiate and classify ecologically significant segments of the land and water surface, rapidly and at a small scale; (2) to identify opportunities and limitations for particular types or combinations of land use, and hence provide a management tool for resource planners; and (3) to relate management practices to land productivity in a qualitative and quantitative manner so that management alternatives can be identified.

Vold (1978) presented a case study that provides a realistic application of the biophysical program. In addition, many project reports have been written using the biophysical classification system.

At an international inventory symposium held in Phoenix, Arizona, Demarchi and Chamberlin (1977) summarized the Canada Land Inventory program as it was applied to wildlife in British Columbia; also, they outlined the new ungulate biophysical capability classification as it was being developed.

An updating of the ungulate biophysical capability program was presented to the Northwest Chapter of the Wildlife Society of Banff, Alberta by Demarchi et. al. (1980). While a draft methodology has been available since the mid-1970's, the wildlife staff of the B.C. Terrestrial Studies Branch are currently preparing a biophysical wildlife (ungulate) capability classification for publication.

A classification for rating forage production, primarily for ungulates (both livestock and wildlife) has been published by Demarchi and Harcombe (1982).

In British Columbia we apply three main concepts to the mapping of wildlife information for planning and management purposes:

1) productivity of land for ungulates can be evaluated in terms of capability as well as existing values

2) food and cover are the primary habitat factors that limit ungulate populations

3) ungulate resources and their habitats can be predicted by interpretation and identification of ecosystem components.

CAPABILITY CLASSIFICATION

In the British Columbia Ministry of Environment, we use the definition of land use capability as defined by Hills et. al. (1973): "land use capability is the potential of an area to produce a specified crop (in this case ungulate species) under specified technological controls. The level of production (for ungulates) is measured in terms of the amount (of ungulates) produced, given the kinds and degrees of limitations which prevent any specific land unit from reaching maximum production."

We assume that only non-intensive habitat management options are available to the wildlife habitat manager, such as: prescribed burning or fire protection, depending on the circumstances or the species being considered; prescribed grazing by cattle; prescribed logging or slashing. In addition, animal harvests or protection are not considered to have an effect on the ability of the habitat to support ungulates.

The technological controls that are considered are different for each discipline that uses the capability concept. For ungulate classification the technological controls are non-intensive. In the case of agricultural crops, standard, intensive agricultural practices are acceptable, i.e. irrigation, fertilization, spraying, dyking, drainage and winter feeding are considered intensive management practices. Obviously if such techniques were used by wildlife managers, there could be more ungulates produced in some areas.

In the definition of capability used for forage production, Demarchi and Harcombe (1982) recommended that forested sites are to be rated twice, once at a post-clearing (or burning) stage and once at a mature forest stage. They also suggest that for some studies, forage capability can be rated for each successional stage. Either of these two options is available to the wildlife land classifier; however, at present ungulate capability ratings are only applied to reflect the one point in successional trends that gives the highest production for each ungulate species being rated.

The ungulate capability classes have been arrived at by determining the optimum numbers of a given species that could be supported on excellent habitat for the period of one year (number of animals/square kilometre/year). Lower quality habitats are rated proportionally lower. And, in order to provide an equitable, province-wide, rating scale, extremely high quality habitats are rated proportionally higher (these are termed superclasses). Ranges that are not used year-round must support proportionally higher animal numbers, to achieve the same rating as year-round ranges. For example, a land unit that can support 11-13 elk per square kilometre year-round is a class 1 range; a winter range that is used for six months must be able to support 22-26 elk per square kilometre in order to be rated as a class 1 winter range.

Finally, each habitat is identified as to the season or predominant use by each ungulate species. Currently, we only identify winter use ranges and non-winter use ranges. But there is the option of identifying other seasonal use ranges i.e. rutting grounds, natality sites, spring use ranges and fall use ranges.

LIMITING FACTORS

Every biological system has limits to its growth; important limiting factors are those environmental parameters that relate to food and cover (Thomas et al. 1979, Dasmann 1964, and Andrewartha and Birch, 1954). Each ungulate population is affect-

ed by many factors, and it is often difficult to identify a single limiting factor due to the complexity of interactions involved in a functioning ecosystem. However, in the British Columbia Ministry of Environment, we feel that the most important factors that require protection from non-wildlife or conflicting land uses are those factors which relate directly to the habitat. The regulation of predators, diseases, interspecific competition and harvesting are easily reversible and secondary to the preservation of habitat.

The food and shelter needs of ungulates, both at the individual and at the population level can only be obtained through various habitat elements. Since wildlife cannot create their own food and shelter it must be obtained from the natural environment.

Most importantly, forage and shelter requirements for each species can be predicted and areas that can provide one or both of these needs can be identified. The extent to which these factors provide for the needs of wildlife in different areas can be determined thereby establishing an importance ranking for these areas.

BIOPHYSICAL CLASSIFICATION

The biophysical classification system has its foundation in the ecological formulation presented by Jenny (1941) and Major (1951). They suggest that both soils and vegetation are a function of climate, geologic parent material, relief, organisms and time. Each factor can be analyzed, or determined and, therefore, its contribution to the function of an ecosystem can be evaluated.

Using the biophysical classification concept in a mapping program can be viewed as a building block process that encourages the synthesis of physical and biological data (landforms, materials, soils, climate, vegetation and organisms) to form "ecologically significant" units of the landscape (Walmsley 1976). The process of delineating these units involves the identification of various phenomena each of which is an end-point for the appropriate discipline, but when combined provides the basis of the biophysical map unit. Each unit which is judged to have different carrying capacities and opportunities for supporting ungulates are designated as map units and are given a capability rating for each ungulate species that can occur there. Land units with similar potential, and biological productivity are identified by using an ecologically based, integrated soils and vegetation program.

Following the identification of land units of similar potential a subsequent step that remains is to assign an environmental condition factor that best summarizes the dominant biophysical or ecological processes representing that unit (Demarchi, et al. 1980). Capability maps often list limiting subclasses in conjunction with the capability class rating. This implies that this limiting factor prevents that unit from attaining a higher rating. However, the limiting factor concept is only practical in either total ungulate biomass or single species biomass classifications. It does not work when rating a unit for many species simultaneously. For example, lush, riparian habitats may be most productive in providing total ungulate biomass or even total moose or white-tailed deer biomasses, but mountain goats will not survive there; in fact, they do best on steep, rocky, alpine-like terrain, where biological productivity is lower.

At the inception of the biophysical program in British Columbia it was decided that there was merit in providing a capability rating that expressed the ability of individual species to survive or be produced on a land unit. The alternative, that of providing an ungulate biomass capability was rejected. Thus, we are able to make a better case at the planning table for species such as mountain goats, and woodland caribou which live in low productivity habitat. However, if we were to use the Canada Land Inventory classification criteria those species tend to be passed over. The disadvantage of not being able to identify units which produce the highest ungulate biomass is more than compensated for by being able to identify units which are most productive for each ungulate species.

When evaluating the capability of a land unit to support each ungulate species, interspecific competition is not considered. While in reality competition does exist, the wildlife manager may wish to have an estimate of potential for a selected ungulate species, as management priorities could change in time. Therefore, it is considered useful to provide the manager with the individual potential of all the species, leaving the manager to determine the level to manage each species.

DISCUSSION

Perhaps nothing has confused biologists and

natural resource planners as much as the concept of rating the inherent capability of the land for its ability to support ungulates irrespective of its current vegetative state. This may be because of the theoretical problems of evaluating what is present and what could occur given some management impact or it could be because of biologists' paranoia in trying to classify potential when land development or other conflicting land uses are diminishing existing wildlife habitat.

Factors that biologists and planners can change are more accepted by them than are factors that are more political or of a long-term ecological nature. For example, most biologists do not hesitate to ignore hunting when trying to preserve a piece of habitat; to them, a bighorn sheep range that has had the bighorns over-harvested is still a bighorn sheep range.

The problem arises in areas where seral succession sharply alters the suitability of use for an ungulate species. If an area such as a seral shrub, mule deer range succeeds to a dense conifer forest, supporting no deer, is it still a mule deer range? Are ranges that have been dissected by highways, railroads or subdivisions still wildlife ranges? By using the capability concept, any land unit that still has the potential to support ungulates through acceptable management practices is classified as a wildlife range and is therefore rated on its potential to support various ungulate species. Any land unit that has been permanently altered from its natural state, is rated on its new site potential rather than its now unachievable, past potential.

There is also the argument that if capability ratings are applied to the habitats of some ungulate species, entire regions would be rated for that species. The fear is that such species will be given short shrift by planners, because of the general nature of their distributions. However, if an ungulate has a wide-spread land use pattern, then it should not be relegated to a status less than that by the biologists. If these ungulates and their habitats are to be preserved from dissection or desecration then the full extent of their potential habitats must be identified. For example, the woodland caribou's ecological strategy is one of flexibility in habitat selection and geographical location. To only consider present habitat use is misleading and will ultimately result in management problems when trying to enhance the caribou resource.

Finally, there is the problem of how to rate farmland, particularly extensive farmland. For example, should the prairies be rated for buffalo or the Fraser Delta for Roosevelt elk? The reality of the situation is that a farmed site has been altered by plowing and fertilization and so the natural capability of that site is no longer relevant; that site's capability is now one of a disturbed soil site. Also, the definition of capability being applied does not allow for large-scale changes in land use, such as a major land purchase and replanting schemes for wildlife management purposes.

Land which has been "permanently" (according to the discretion of the mapper) altered by incompatible uses is classed as having lost its natural capability to support wildlife. If the soil of a site has been changed, then the capability of that site has been altered and a new site potential must be established. Disturbance by noise or human presence is not considered to have an effect on a site's capability.

For clarification of our mapping strategy, sample biophysical capability maps for ungulates and forage are presented. Figure 1 is a simplified legend for use with the biophysical wildlife (ungulate) capability maps (Figures 2 and 3); and Figure 4 is a simplified legend for use with the biophysical forage capability map (Figure 5).

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Map Symbol

Capability Rating

Ungulate Species → $\dfrac{X^1E^3M_4W_4}{\underbrace{\mathrm{Lf\ Sm}}_{\text{Environmental Conditions}}}$

Superscript rating indicates winter range

Subscript rating indicates summer range

Ungulate Species Symbols

X... Moose	M... Mule Deer	W... White-tailed Deer	G... Mountain Goat
E... Elk	B... Black-tailed Deer	C... Caribou	S... Mountain Sheep

Capability Classes

CLASS 1: Lands in this class have very high capability to support the assigned ungulate species. When required, this class may be subdivided on the basis of productivity into classes 1a, 1b and 1c.

CLASS 2: Lands in this class have high capability to support the assigned ungulate species.

CLASS 3: Lands in this class have moderate capability to support the assigned ungulate species.

CLASS 4: Lands in this class have low capability to support the assigned ungulate species.

CLASS 5: Lands in this class have very low capability to support the assigned ungulate species.

CLASS 6: Lands in this class have no capability to support the assigned ungulate species.

Environmental Conditions

CLIMATE

Pa - RAIN SHADOW
Sh - HIGH SNOW
Sm - MODERATE SNOW
Sl - LOW SNOW
Ss - INTENSIFIED SOLAR RADIATION
Sw - WINDSWEPT SNOW
Sp - SNOWFIELDS AND GLACIERS
Tc - COLD AIR LAYER
Tw - WARM AIR LAYER
Tf - FROST POCKETS
Th - HIGH HEAT
Ta - ALPINE ARIDITY
We - EXPOSURE

ANTHROPOGENIC

Hu - URBAN DEVELOPMENT
Hi - INDUSTRIAL DEVELOPMENT
Hr - TRANSPORTATION CORRIDORS
Hh - RESERVOIR DRAW-DOWN ZONE
Hc - CULTIVATED LAND

SOILS AND LANDFORMS

La - AVALANCHE TRACTS
Le - SOIL EROSION
Lw - FAILING SLOPES
Ls - STEEP SLOPES
Ll - LEVEL LAND
Lr - ROLLING OR HILLY LAND
Lf - ACTIVE FLOODPLAIN
Li - FRESH WATER INUNDATION
Lt - TIDAL INUNDATION
Ef - UPLAND FOREST SOILS
Es - OPEN FOREST SOILS
Eg - GRASSLAND SOILS
Em - SUBALPINE MEADOW
Eo - ORGANIC SOILS
Et - TALUS
Er - BEDROCK
Eb - ALKALINE SOILS
Es - SALINE SOILS
Eh - MOIST SOIL
Ex - DRY SOIL
Ew - DEEP FLUVIAL DEPOSITS
El - DEEP LACUSTRINE DEPOSITS

Figure 1: A Simplified Example of a Biological Wildlife (Ungulate) Capability Map Legend, for use with Figures 2 and 3.

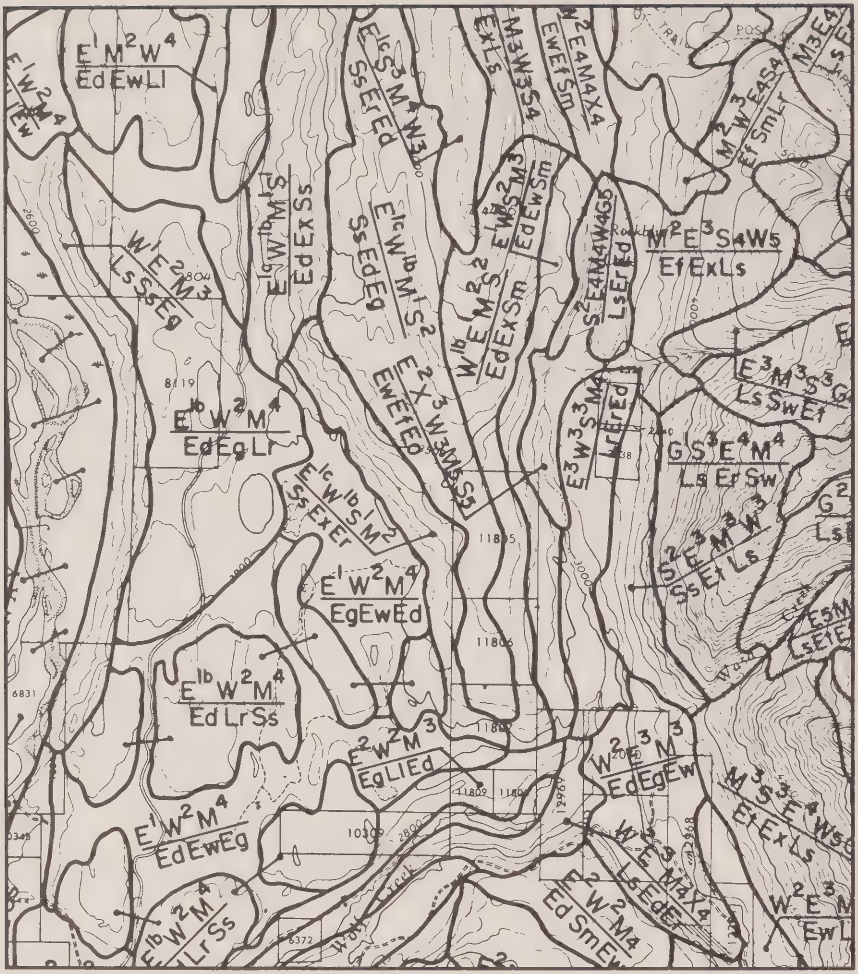

Figure 2: Biophysical Wildlife (Ungulate) Capability Map at an Inventory Scale of 1:50 000.

Figure 3: Biophysical Wildlife (Ungulate) Capability Map at an Inventory Scale of 1:250 000.

Examples of Map Symbols

a) Forested units are rated for herbaceous and woody plants and fruticose lichens as cleared sites and as forested sites at or near rotation age (maturing seral):

Single Unit

CAPABILITY CLASS

CLEARED SITE CATEGORY	{	$1_G\ 1_B$
FORESTED SITE CATEGORY	{	$2_G\ 2^B_C$
ENVIRONMENTAL CONDITIONS	{	Ss Ed Eg

FORAGE TYPES

b) Nonforested units are rated for herbaceous and woody plants and terrestrial lichens at a climax stage only:

CAPABILITY CLASS
PERCENTAGE OF MAP UNIT

NONFORESTED SITE CATEGORY	{	$5^S_F\ 1^6_B$	$1_S\ 5^4_B$
ENVIRONMENTAL CONDITIONS	{	Lf	EoVh

FORAGE TYPES

Capability Classes

CLASS 1 Lands in this class have very high capability to produce the assigned forage type

CLASS 2 Lands in this class have high capability to produce the assigned forage type

CLASS 3 Lands in this class have moderate capability to produce the assigned forage type

CLASS 4 Lands in this class have low capability to produce the assigned forage type

CLASS 5 Lands in this class have very low to no capability to produce the assigned forage type

Forage Types

H... herbaceous plants	W... woody plants	L... lichens
F.... forbs	B.... shrubs	T.... terrestrial fruticose lichens
G.... grasses	C.... conifer trees	
S.... sedges	D.... deciduous trees	A.... arboreal fruticose lichens

[1]Lichens are only rated where they are an important food source.

Environmental Conditions

CLIMATIC

Pa - RAIN SHADOW
Sp - SNOWFIELDS AND GLACIERS
Ss - INTENSIFIED SOLAR RADIATION
Sw - WINDSWEPT SNOW
Ta - ALPINE ARIDITY
Tc - COLD AIR LAYER
Tf - FROST POCKETS
Th - HIGH HEAT
Tw - WARM AIR LAYER
We - EXPOSURE

ANTHROPOGENIC

Hc - CULTIVATED LAND
Hh - RESERVOIR DRAW-DOWN ZONE
Hi - INDUSTRIAL DEVELOPMENT
Hr - TRANSPORTATION CORRIDORS
Hu - URBAN DEVELOPMENT

ECOLOGICAL

Ea - ALKALINE SOILS
Eb - STONY SOILS
Eg - WET SOILS
Eh - MOIST SOILS
El - DEEP LACUSTRINE DEPOSITS
Eo - ORGANIC SOILS
Er - BEDROCK
Es - SALINE SOILS
Et - TALUS
Ew - DEEP FLUVIAL DEPOSITS
Ex - DRY SOILS
La - AVALANCHE TRACTS
Le - SOIL EROSION
Lf - ACTIVE FLOODPLAIN
Li - FRESH WATER INUNDATION
Lo - OPEN WATER
Lt - TIDAL INUNDATION
Lw - FAILING SLOPES
Vh - HERBACEOUS COMPETITION
Vs - SHRUB COMPETITION
Vt - TREE COMPETITION

Figure 4: A Simplified Example of a Biophysical Forage Capability Map Legend for use with Figure 5.

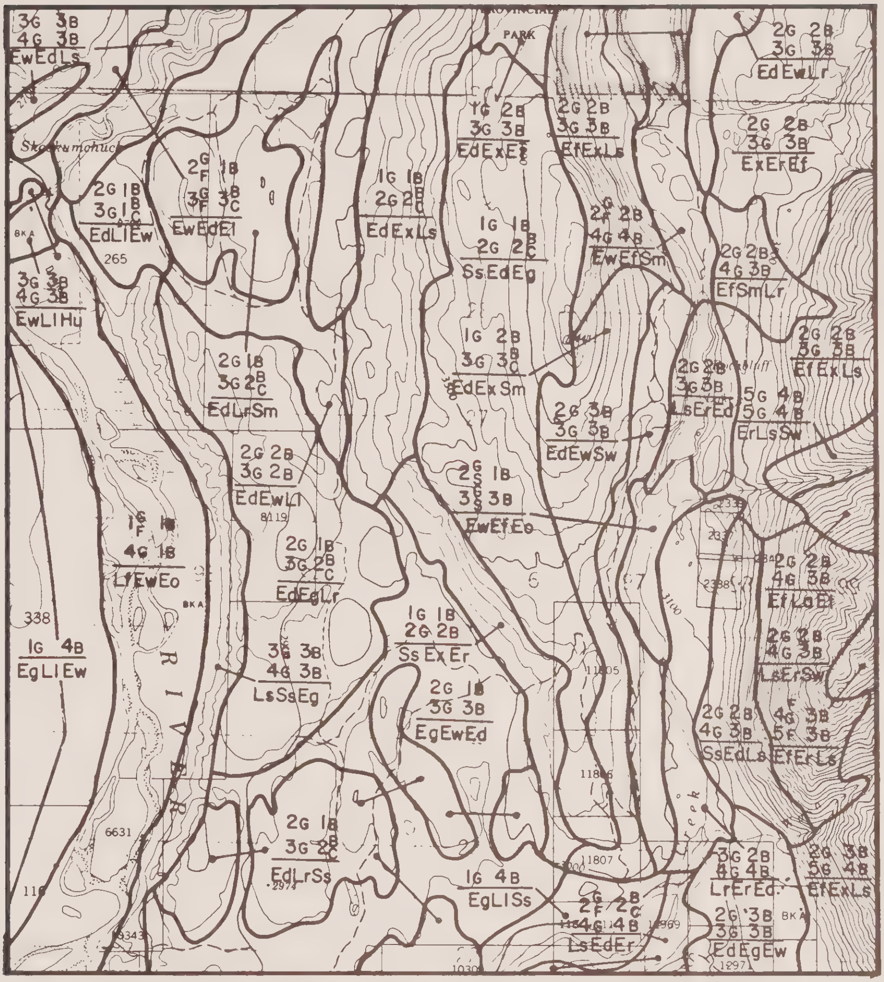

Figure 5: Biophysical Forage Capability Map at an Inventory Scale of 1:50 000.

VISUAL INTERPRETATION OF LANDSAT IMAGERY FOR CARIBOU HABITAT CLASSIFICATION

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ABSTRACT

Canada's northern wildlands are experiencing rapid development through the activities of the resource extraction and tourism industries. To wildlife managers this means an ever-increasing encroachment on wildlife habitats. The effectiveness of their management decisions is now partially dependent on developing rapid, cost-effective means of assessing habitat. This study was initiated to evaluate the visual interpretation of LANDSAT satellite imagery as a management tool for small scale, reconnaissance level habitat mapping of the range of the Redstone River caribou herd in the Mackenzie Mountains, Northwest Territories. The vegetation communities in the tundra subarctic forest biome which are preferred seasonal habitats of caribou were represented by twelve Habitat Mapping Units (HMU). Using visual interpretation techniques and helicopter aerial fly-overs for field data collection, 17 image classes were delineated on a 1:250,000 scale enhanced satellite image. Eleven of the 12 HMU's were found to have unique spectral response patterns. The study stresses the need for visual analysis as the initial approach in the interpretation of satellite multispectral scanner data. The close correspondence between image classes and HMU's and the relatively small amount of field time necessary to prove out that correspondence, demonstrate that LANDSAT imagery can provide an operational, economic basis for habitat classification in arctic and subarctic environments.

RÉSUMÉ

Les terres sauvages du Nord canadien connaissent un développement rapide à cause des activités d'exploitation des ressources et de l'industrie du tourisme. Pour les responsables de la faune, cela signifie une menace grandissante pour les habitats fauniques. Aujourd'hui, la valeur de leurs décisions dépend en partie de la mise sur pied de moyens rapides et efficaces, du point de vue des coûts, d'évaluer les habitats. On a réalisé cette étude pour évaluer l'interprétation visuelle des images transmises par le satellite LANDSAT comme outil de gestion pour la cartographie de reconnaissance à petite échelle des habitats et de l'aire de dispersion de la harde de caribous de la rivière Redstone, dans les monts Mackenzie (T.N.-O.). Les communautés végétales du biome forestier de la toundra subarctique, qui sont les habitats saisonniers préférés des caribous, ont été représentées par douze unités de cartographie d'habitats (UCH). Au moyen de techniques d'interprétation visuelle et de survols en hélicoptère, pour la collecte de données sur le terrain, on a déterminé 17 catégories d'images sur une représentation à une échelle de 1:250 000, tirée d'une image-satellite améliorée. On a constaté que 11 des 12 UCH ont des configurations de réaction spectrale uniques. On insiste sur la nécessité de commencer par l'analyse visuelle pour l'interprétation de données obtenues par balayage multispectral par satellite. L'étroite relation qui existe entre les catégories d'images et les UCH et le temps relativement court passé sur le terrain pour démontrer cette correspondance prouvent que les données graphiques du LANDSAT peuvent constituer une base opérationnelle et économique pour la classification des habitats en milieux arctiques et subarctiques.

INTRODUCTION

Wildlife managers have consistently been faced with the dilemma of having to make resource management decisions with the best available information, which is often considered insufficient. This information base usually involves pertinent wildlife data on population distribution and dynamics, and range utilization by a given species. With the rapid development of Canada's northern wildlands, a new data gap has surfaced which

jeopardizes the effectiveness of management decisions. The relative remoteness and associated costs of conducting field work in these areas are obstacles to obtaining up-to-date land inventory data with which to assess the available habitat for northern wildlife species. As competition for the land base increases, this type of information becomes more critical for the maintenance of productive wildlife populations.

A case in point is the Redstone River woodland caribou *Rangifer tarandus caribou* herd which inhabits the southern Mackenzie Mountains of the Northwest Territories. Recently, human activity within the region has exploded. It is now supporting intensive mining and exploration projects, outfitter areas for non-resident sport hunters, resident sportsmen from the N.W.T., native hunters from the communities along the Mackenzie River as well as from neighbouring towns in the Yukon Territory, and recreational tourists visiting the recently constructed naturalists' lodge. Major increases in both consumptive and non-consumptive use of the caribou herd and its habitat are anticipated.

Recognizing the potential conflict between wildlife and other land uses, the N.W.T. Wildlife Service supported a research project which examined and integrated all available pre-existing data on this herd and developed the initial framework from which a preliminary management plan could be formulated (Collin, in prep). It was agreed that if management practices were to be directed toward conservation of this caribou herd, a rapid, cost-effective means of identifying caribou habitat was necessary. Several data sources were therefore investigated. The applicability of LANDSAT satellite technology as a management tool for small scale, reconnaissance level habitat mapping of northern ecosystems became a major component of the project and is the thrust of this paper.

STUDY AREA

The Mackenzie Mountains are situated east of the Yukon-N.W.T. border and west of the Mackenzie River (Figure 1). The study area within this mountain range lies between latitude 62°N and 65°N and longitudes 126°W and 131°W and includes the extreme summer and winter range limits of the Redstone River herd. The climate of the area is continental in character with short, relatively warm summers and long, cold winters. The topography is generally mountainous and fairly rugged with local relief as great as 1550 m. Maximum elevations range between 2150 and 2500 m and valleys lie slightly below 1250 m, the approximate elevation of treeline (Blusson, 1971).

The vegetation in the study area has been classified as Alpine-Forest Tundra (Rowe, 1972). The summits and upper slopes of the Mackenzie Mountains are far enough above treeline for the development of arctic-alpine vegetation communities. At lower elevations in the north, east, and southeast portions of the area, a subarctic forest vegetation zone prevails. To the southwest is an alpine tundra vegetation zone. These vegetation zones support a diverse, relatively abundant big game resource base which includes caribou, Dall's sheep (*Ovis dalli*), mountain goat (*Oreamnos americanus*), moose (*Alces alces*), grizzly (*Ursus arctos*) and black (*Ursus americanus*) bear.

APPROACH

In developing a mapping program suitable for habitat classification of Canada's northlands, the type of mapping procedure employed must be selected on the basis of its intended use. If the ultimate aim is to provide a reliable yet rapid, economical means of reconnaissance level mapping, then the procedure should satisfy a number of requirements:

- Because field work constitutes the major cost associated with habitat mapping, the procedure used should reduce this time to a minimum yet still produce a reliable and accurate classification of the landscape.
- For the same reason as above, it should be possible to extend the field data over large areas of land having similar ecological conditions.
- Because of the expense of acquiring new field data, it would be particularly advantageous if pre-existing information could be easily integrated into the procedure.
- The procedure used for lab interpretation of materials should not require extensive retraining of the analyst.
- Because it is essential that the analysis techniques be transferable from one interpreter to another, the procedure should attempt to provide objective, standardized criteria for delineating mapped areas.

To date, biophysical inventories in the Mackenzie Mountains have not been conducted. There exists very limited information pertaining to the soils, surficial geology, geomorphology and vegetation of the area. The information that does exist is either too general (eg Blusson, 1971; Miller and Barichello,

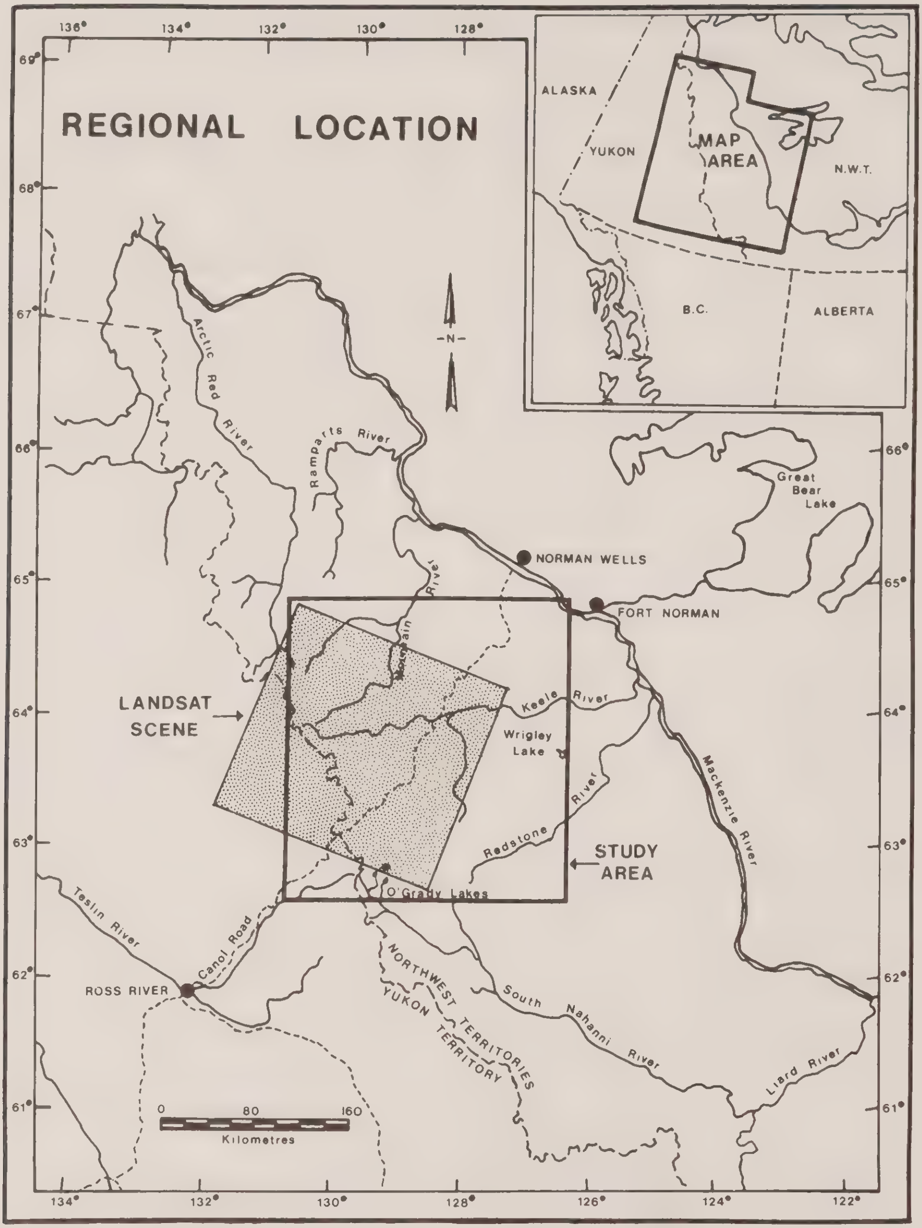

Figure 1: Location of study area.

1979) or confined to very small areas within the Mackenzies (eg AMAX, 1976). Conventional airborne photography is limited to outdated 1949 black-and-white coverage of insufficient scale and resolution for habitat mapping purposes. The cost of flying an acquisition mission for the necessary aerial photography was beyond the budgetary means of the study. Consequently, the only affordable alternative that could be acquired in a reasonable amount of time was LANDSAT satellite imagery.

Visual interpretation techniques as opposed to computer assisted classification techniques were used to assess the capabilities of LANDSAT. The correspondence between patterns recognized to the LANDSAT image and those developed to the classification of vegetation data during field studies formed the basis for image analysis.

The methodology developed by Ross and Aronoff (1980) for integrating airphoto analysis and vegetation data was adopted. This procedure is based on the visual discrimination of photoclasses and vegetation communities. The photoclass is determined by the features distinguishable on the airphoto whereas the vegetation classes delineate the landscape into ecologically relevant units. The intent is to systematically evaluate the capacity of the remote sensing system to distinguish different vegetation communities at the desired level of mapping. The measure of the system is the degree and level of consistency to which a unique photoclass can be assigned to each vegetation class.

The intent was not to produce an Ecological (Biophysical) Land Classification of the Mackenzie Mountains, but rather to develop a procedure which goes beyond single resource-based classifications and is suitable for use with LANDSAT image interpretation. The methodology seems to be particularly suitable for habitat studies in the North, where existing biophysical information may be scarce, because the surface cover and physiographic data that are required to produce a land classification for wildlife are readily obtainable from aerial surveys and topographic maps.

The habitat classification derived herein has an ecological basis since vegetation cover and physiography reflect the ecological conditions present in each unit. Inferences about soil conditions, surficial materials and drainage can be made from the growing conditions required for each vegetation class but a considerable amount of additional field data would be required to integrate these factors into the classification scheme. For the purpose of this classification the value of the added information was not considered commensurate with the high cost of obtaining it. The procedure followed in this study is user oriented and driven by the need to produce manageable land units which provide meaningful information about caribou habitat to wildlife managers.

LANDSAT TECHNOLOGY

Since the initial launching of the first Earth Resources Technology Satellite (ERTS, presently called LANDSAT) in 1972, three generations of satellites have provided Canada with an important resource data gathering instrument. Each area of Canada is covered at least once every eighteen days with areas in the high north receiving successive coverage as frequently as five days (Thie, 1976). The multispectral scanner (MSS) on board each satellite measures reflective radiation in four bands of the electromagnetic spectrum. These are green, red, near-infrared, and infrared and are indicated on the LANDSAT image as MSS bands 4, 5, 6, and 7, respectively.

The MSS data transmitted by LANDSAT satellites are recorded on magnetic tape at the Canadian receiving stations in Prince Albert, Saskatchewan and Shoe Cove, Newfoundland. From these tapes, photographic copies of the MSS data and computer compatible tapes (CCT's) can be generated. The MSS data are presented in blocks which comprise a LANDSAT scene. An individual scene records an area of approximately 185 km by 185 km (34,000 sq km) and is comprised of over seven million picture elements (pixels). For each pixel there are four radiance measurements corresponding to each of the four spectral bands recorded by the MSS scanner. The minimum resolution of the MSS data is determined by the size of each pixel which is 77 m north-south by 58 m east-west, or approximately 0.44 ha (Thie, 1976).

The spectral response patterns of different earth surface cover types recorded on each spectral band help discriminate between certain landscape features. The colour, texture and spatial configuration of the pixels contained in a LANDSAT image produce unique spectral reflectance signatures. Both cultural and biophysical features can be identified from these spectral signatures. Vegetation morphology and phenology, topographic variation and moisture regimes are the major influences which dictate the spectral response patterns of a given landscape feature.

MATERIALS AND METHODS

Limitations

The time frame for this project and the funds available limited the amount of field time spent on aerial reconnaissance surveys and ground truthing. It was possible to map only a portion of the herd's range, approximately 5%, but these areas were selected to be representative of the ecological regions found throughout the range. Thus the habitat classification developed for this study could be extended over a much larger land mass with a marginal investment of time and money.

Insufficient ground truth data and unsuitable existing airphoto coverage did not permit a quantitative, statistical evaluation of habitat classification accuracy. The procedure employed does, nonetheless, provide some qualitative comparisons between habitat ground classes and image map units.

The 1:250,000 scale selected for mapping is suitable for generating an initial baseline habitat inventory at the reconnaissance level from which more intensive studies could be initiated. Even at this scale, there exist subtle variations in the imagery data which could possibly be further classified with additional ground truthing.

Mapping Area

Mapping effort was focussed on that portion of the herd's ± 60,000 sq km range which was believed to have the greatest potential for receiving impacts from mining and recreation operations. The areas selected for mapping support large concentrations of calving and post-calving caribou. Consideration was also given to accessibility, logistic support and existing reference data.

The western half of the herd's range was considered the most appropriate portion in which to conduct the habitat classification. Within this area two ecological zones are discernible: the subarctic forest and subarctic tundra vegetation zones. Representative areas from both vegetation zones were selected for detailed habitat classification from LANDSAT imagery.

Image Selection

The reliability and accuracy of information interpreted from LANDSAT imagery is enhanced by the use of multidate imagery (Thie, 1976; Colwell, 1978; Hofer, 1978). Therefore, two cloud-free LANDSAT scenes, one at the height (July) and one at the end (September) of the growing season were obtained from the Canada Centre for Remote Sensing (CCRS) in Ottawa. Initially, the standard, commercial product (a colour composite of bands 4, 5, 7) at a scale of 1:250,000 was to be used for interpretation. Upon examination of the hard copy products, it was evident that the spectral resolution of the imagery was insufficient and that these images were unsuitable for mapping purposes using visual interpretation techniques.

Past experience with enhanced satellite image products from the Earth Satellite Corporation (EarthSat), Washington, D.C. (TES Research, 1981; Claasen, 1981) has proved their effectiveness for general resource mapping, albeit at a higher cost than CCRS products. This higher cost dictated that only a single scene be used for interpretation. Since the September 1976 LANDSAT scene originally obtained from CCRS showed a higher contrast and better spectral separation than the July image, EarthSat processed the CCT of this scene (ID number 20608 - 19152) at scales of 1:1,000,000, 1:250,000 and 1:100,000. All interpretation and habitat classification was conducted on the "Geopic" Series K enhanced image at a scale of 1:250,000.

EarthSat's standard Geopic images are generated from computer compatible tapes and are produced by optically combining MSS bands 4, 5, and 7 to yield a simulated colour-infrared composite. The Geopic image enhancement process uses a series of proprietary algorithms which are outlined below:

- Geometric corrections maximize geometric accuracies and facilitate the superimposition of overlay maps.
- Radiometric corrections maximize the uniformity of tone and/or colour with which features of a given category are imaged.
- Edge enhancement corrections increase the contrasts in colour and density along feature boundaries thereby improving the analyst's ability to identify linear and other border features.
- Scan line suppression removes regularly spaced scan lines in an image, produced by repetitive malfunction of the MSS detectors (Sheffield, 1981).

Several attempts were made to geometrically register the image to the corresponding National Topographic Series maps but, due to variations in topographic map accuracy, these were unsuccessful.

Image Interpretation

Prior to image analysis, the existing vegetation field data (AMAX, 1976; Miller and Barichello, 1979; Kershaw, in prep) and black-and-white airphotos of selected areas were examined to provide an indication of the actual vegetation communities present within the areas to be mapped. In developing the final vegetation ground classes, consideration was also given to the seasonal use by caribou of each cover type. A review of other caribou range studies in similar ecological regions (Pegau, 1972; Laperriere, 1976; Cihlar *et al*, 1978; Oosenbrug, 1976 and Dixon, 1981) provided a list of anticipated caribou associated habitat types. This eliminated unnecessary detail in vegetation community delineations and provided an appropriate mapping unit for reconnaissance level habitat classification. Each *Habitat Mapping Unit* (HMU) incorporated both floristic composition and the physical attributes of the landscape and was characterized by being mappable on the ground.

Once the anticipated habitat classification units were determined, the LANDSAT image was pretyped into *LANDSAT Mapping Units* (LMU). Using standard visual interpretation techniques (American Society of Photogrammetry, 1975), a series of units with unique spectral reflectance signatures was produced. These LMU's were based on combinations of the pixels contained in the LANDSAT scene. Similar pixels were grouped according to pattern, colour, texture, and spatial organization. These factors, often referred to as a *theme*, were then evaluated in the field and in the lab to see if there existed unique themes for a given HMU or a combination of HMU's. When the HMU and LMU were taken in combination the resultant unit was termed an *image class*. The image class was the final unit of mapping used for habitat classification of the LANDSAT image.

To measure the consistency with which a given theme characterized an HMU, aerial flyovers were conducted in August 1981 in a Bell 206B helicopter. Ten hours of aerial survey time provided field data for 125 sampling locations. Helicopter flyovers provided a fast, efficient means of surveying large tracts of land and provided sufficient vegetation and physiographic information to determine whether or not an LMU corresponded to the assigned HMU. The use of a helicopter also allowed ground truthing in areas where more detailed habitat information was required.

During aerial flyovers photographic records were maintained of the surveyed vegetation ground classes using a 35 mm camera and Kodachrome colour slide film. These slides and recorded field data were the major means of checking boundaries for map units and were used to identify relationships between LANDSAT Mapping Units and caribou Habitat Mapping Units.

RESULTS

Image Classification

Based on the existing reference data, 12 Habitat Mapping Units were selected as being representative of the vegetation cover types present in the tundra-subarctic forest biome as well as being preferred seasonal habitats of caribou. Table 1 gives the name of each HMU along with the topographic location, aspects, elevation, and dominant plant species which characterize each unit. According to Mueller-Dombois and Ellenberg's (1974) physiognomic-ecological classification of plant formations, these HMU's can be assigned to six ecologically distinct broad-based vegetation classes: subalpine shrubland, closed canopy forests, open woodlands, dwarf scrub, hummocky tundra, and wetlands.

The field data gathered during aerial flyovers were plotted on an acetate overlay of the LANDSAT scene and then compared with the themes of each LANDSAT Mapping Unit. The combination of spectral signatures and vegetation/physiographic field data yielded 17 distinct image classes. All six ecologically-distinct vegetation classes that encompassed the 12 HMU's could be delineated on the imagery. In fact, the spectral response patterns were so consistent and unique for a given vegetation cover type that the subalpine shrubland class was further delineated into four subclasses and the closed canopy forest and hummocky tundra classes were each divided into two subclasses. Water bodies, bare rock, and unclassified areas completed the classification of the mapped areas within the LANDSAT scene.

The 17 image classes are listed in Table 2 along with their assigned map symbols. Table 3 shows the relationship between the image classes and their characteristic themes as they appear on the LANDSAT image. The classified portions of the image are reproduced as Figures 2 and 3.

Brief descriptions of the image classes follow:

Lichen dominated tundra (1A) - This image class is found at subalpine elevations over level to gently undulating terrain. It is characterized by a thick carpet of *Cladonia* lichens and the occasional clump of dwarf birch. The

Figure : Classification of mapped area within the LANDSAT scene: Subarctic forest vegetation zone (see Table 3 for legend).

Figure 3: Classification of mapped area within the LANDSAT scene: [illegible] dra vegetation zone (see [illegible]le 3 for legend).

Table 1: Habitat Mapping Units and their vegetation and physiographic characteristics

Habitat Mapping Unit	Elevation	Aspect	Topographic Location	Dominant Plant Species Cover	Caribou Seasonal Utilization (Calef, 1974; Pegau, 1972)
Lichen tundra	> 1200 m	flats	subalpine	lichens (*Cladonia spp.*, *Cladina spp.*), dwarf birch (*Betula glandulosa*)	early summer, late fall, early winter
Shrub birch-lichen	1200 - 1500 m	flats and south slopes	bottomland	dwarf birch, lichens, willows, (*Salix barratiana, S. alaxensis, S. polaris, S. glauca, S. pulchra*), dryas (*Dryas spp.*), bell heather (*Cassiope tetragona*), mosses	early summer, early fall, winter
Riparian shrubland	< 1500 m	flats, south slopes	valley bottoms	dwarf birch, willows, horsetail (*Equisetum arvense*), Fescue grass (*Festuca altaica*)	late spring, late summer, early fall
Willow-forb shrub-land	1400 - 1700 m	south slopes	upland	willows, ground willows (*Salix reticulata*), dwarf birch, Arctagrostis (*A. latifolia*), horse-tail, mosses	early - mid summer
Forb tundra	up to 1800 m	all aspects, especially south slopes	variable, upland to lowland	ground willow (*Salix arctica, S. reticulata*), arctic wormwood (*Artemesia arctica*), sedges (*Carex spp.*), mosses, lichens	early - mid summer
Coniferous forest	< 1200 m	flats, south slopes	lowland	white spruce (*Picea glauca*), black spruce (*Picea mariana*)	late spring, late fall, winter
Mixed forest	< 1200 m	flats	valley bottoms	white spruce, balsam poplar (*Populus balsamifera*), paper birch (*Betula papyrifera*), alder (*Alnus spp.*)	late spring, early fall
Open lichen wood-lands	up to 1200 m	flats, south slopes	lowland	white and black spruce, lichens, mosses	winter
Lichen-heath tundra	> 1500 m	all exposed aspects and plateaus	alpine	lichens, bell heather, alpine bearberry (*Arctostaphylos rubra*), arctic blueberry (*Vaccinium uliginosum*), narrow-leafed labrador-tea (*Ledum palustre*), arctic worm-wood, mosses	mid - late summer, winter
Tussock grass tundra	> 1200 m	flats, exposed southern slopes	subalpine	fescue grass, cottongrass (*Eriophorum vaginatum*), arctagrostis, meadow grass (*Poa spp.*), ground willows, mosses	late spring, early mid summer
Sedge-moss tundra	1200 - 1500 m	flats	subalpine	sedges (*Carex spp.*), dryas, cottongrass, mosses	all summer
Sedge meadow	900 - 1500 m	flats	variable, low-land to subalpine	water sedge (*Carex aquatilis*), cottongrass, mosses	all summer, fall, winter

lichen ground cover dominates the spectral signature giving it a mottled pink-brown appearance on the image.

Dwarf birch/willow shrub-lichen (1B) - Occurring over similar terrain only at slightly lower elevations than the previous image class, the denser cover of deciduous shrub produces a more uniform brown colour. Lichens still dominate the ground cover and appear as flecks of grey in the spectral signature.

Alluvial shrubland (1C) - This image class occupies riparian valley bottoms and is characterized by a dense willow and dwarf birch shrub stratum. Willows are the dominant shrub vegetation and their red spectral reflectance signature is distinct from the brown of dwarf birch shrubs. This produces the finely stippled pattern on the image.

Upland shrub willow (1D) - Found at mid-elevations on gentle to moderate, south-facing slopes, this image class consists predominantly of a willow shrub layer with forbs and grasses as ground cover. Dwarf birch shrubs are occasionally interspersed among the willows. A fine textured, red-orange signature characterizes this class.

Coniferous forest (2A) - This image class consists primarily of white and black spruce with some poplar and/or willow, birch, or alder shrub admixed. Although occurring mainly along rivers, this class was also found to occupy long, gentle slopes at low elevations. Since coniferous trees have narrow needles with a small surface area, they do not reflect wavelengths of light in the infrared spectrum to the same degree as deciduous vegetation. Hence the spectral signature of this class is

Table 2. LANDSAT image classes and their relationship to ecologically-distinct vegetation classes.

Physiognomic-ecological classification of plant formations (Mueller-Dombois and Ellenberg, 1974)	Image Classes: Map Symbol	Image Classes: Description
Subalpine Scrubland	1A	Lichen dominated tundra
	1B	Dwarf birch/willow shrub-lichen
	1C	Alluvial shrubland
	1D	Upland shrub willow
Closed Canopy Forests	2A	Coniferous forest
	2B	Deciduous alluvial forest
Open Woodlands	3A	Open lichen coniferous woodland
Dwarf Scrub	4A	Upland heath complex
Hummocky Tundra	5A	Tussock grass tundra
	5B	Sedge-moss-heath tundra
Wetlands	6A	Fens/Sedge meadows
Scarcely Vegetated Rocks and Screes	7	Scarcely vegetated rocks and screes
	8A	Lakes
	8B	Rivers
	8C	Glacial stream beds
	9A	Unclassified-absence of field data
	9B	Unclassified-shadow

a uniform dark magenta.

Deciduous alluvial forest (2B) - This image class occurs only at low elevations along river valleys and is composed of balsam poplar and paper birch. By late September (the date of the LANDSAT scene used), these trees are in senescence and their grey-green spectral signature is only discernible when there are no conifers present to mask the deciduous signature with the much darker conifer signature.

Open lichen coniferous woodlands (3A) - Occupying valley bottoms and long, gentle slopes at low elevations, this class consists of scattered black and white spruce forming the canopy above an extensive ground cover of lichens. The understory is comprised of low density deciduous and evergreen shrubs. This class appears as a mottled grey-magenta colour on the image.

Upland heath complex (4A) - Occurring only at high elevations on more xeric sites of exposed slopes and elevated plateaus, this class includes all alpine vegetation communities. Caespitose shrubs include dwarf birch, blueberry, crowberry, narrow leaved Labrador tea and mountain heather. Dryas, ground willows and mosses form a dense mat of ground vegetation. On moister seepage sites, this image class also includes forb tundra vegetation but it is not distinguishable on this image from the upland heath complex. A uniform salmon-pink colour is indicative of the high reflectance associated with the ground cover vegetation and drier soil conditions. Significant concentrations of heather produce streaks of dark magenta in the spectral signature.

Tussock grass tundra (5A) - This image class is found on poorly drained level terrain at subalpine elevations and is often associated with solifluction stripes. The hummocky terrain, formed by a series of hillocks and hollows, provides a range of microclimates for vegetative growth. Mosses, forbs, and occasional dwarf birch and willow shrubs fill the spaces between the tussocks on which cotton-grass sedges and fescue grasses grow. A coarsely stippled reddish-pink colour is the spectral signature of this class.

Table 3: Classification table for September 1:250,000 scale enhanced LANDSAT scene (EarthSat Geopic Series K)

Symbol	Pattern	Texture	Colour	Image Class
1A	mottled	coarse - medium	pink - brown	Lichen dominated tundra
1B	mottled to stippled	medium - fine	grey - brown	Dwarf birch/willow shrub-lichen
1C	stippled	medium - fine	red - brown	Alluvial shrubland
1D	uniform	fine	red - orange	Upland shrub willow
2A	uniform	fine	magenta	Closed canopy coniferous forest
2B	stippled	medium - fine	grey - green	Deciduous alluvial forest
3A	mottled to stippled	medium - fine	grey - magenta	Open lichen coniferous woodland
4A	uniform to stippled	fine	salmon - pink	Upland heath complex
5A	stippled	coarse - medium	red - pink	Tussock grass tundra
5B	mottled	medium	salmon	Sedge - moss - heath - tundra
6A	various	medium - fine	yellow on various background colours	Fens/Sedge meadows interspersed
7	uniform to stippled	fine	grey - blue, white on salmon and magenta	Scarcely vegetated rocks and screes
8A	uniform	fine	black	Lakes
8B	uniform	fine	dark blue to turquoise	Rivers
8C	uniform	fine	ice blue	Glacial stream beds
9A	various	various	grey - red	Unclassified
9B	uniform	fine	black	Unclassified areas with shadow

Sedge-moss-heath tundra (5B) - This class occupies an environment similar to that of the previous class but on slightly more elevated terrain which provides more suitable conditions for the growth of sedges and the development of a more lush ground cover composed of mosses, lichens, ericaceous and herbaceous vegetation. A mottled salmon colour distinguishes this class from that of tussock grass tundra.

Fens/Sedge meadows (6A) - The areas occupied by water sedges were often too small to delineate at the scale of the imagery. Most often, these sedge meadows and fens are interspersed within subalpine shrubland, tundra or forest vegetation. When found adjacent to ponds and lake margins, this class is composed almost exclusively of water sedge but when interspersed in forest or shrubland areas, the sedges may be admixed with herbaceous plants, mosses and some grasses. Wet sedge meadows and fens are discernible on the LANDSAT image wherever a yellow hue appears mixed in with the pixels of other image classes. Their presence is often detectable but not usually mappable.

Scarcely vegetated rocks and screes (7) - Although this is not a true vegetation class, it is so distinctive on the image and occupies such a large percentage of the study area that it was necessary to assign it an image class. Bare rock dominates this class but some slopes will support heather or spruce. This class also includes the upland heath complex image class where the areal extent of vegetative cover is too small to map. Exposed rock and mineral soil yield a grey-blue colour; wherever ericaceous vegetation or scattered spruce occupy the summits or slopes they are represented by magenta dots within the grey-blue background.

Lakes (8A) - This image class represents deep water lakes with no vegetation growing on the surface and low sediment content. These lakes do not reflect transmitted light, hence are black in colour on the image.

Rivers (8B) - The spatial organization of pixels helps to delineate rivers and streams. Deep water rivers appear as a dark blue-black colour while shallower waters with gravel beds or high sediment content appear blue to turquoise on the image.

Glacial stream beds (8C) Former glacial stream beds consisting largely of gravel outwash are identifiable on the image by their ice-blue colour.

Absence of field data (9A) - Although spectral response patterns could be identified and distinguished from the classified areas, no field data exists for these areas. The spectral signature is unique for gentle north-facing slopes. Since the ecologic conditions for this topographic location are so different from those of any other image class, it was not possible to identify these areas by extrapolation from existing field information.

Shadow (9B) - This class was also found almost exclusively on north-facing slopes. Because of the sun angle (a function of latitude, time of year and time of day) these slopes were in shadow thereby masking the true spectral signature of the cover types with a black colour.

Ease of Interpretation

The methodology adopted for image analysis focussed on the relationship between Habitat Mapping Units and the LANDSAT Mapping Units used to delineate image classes on the LANDSAT scene. The LMU's are the different spectral signatures interpretable from the image while the HMU's describe the features of each surface cover type as seen on the ground. Table 4 is an image interpretation matrix which illustrates the relationship between the two units and shows the relative ease with which the LMU, representing a given image class, can be assigned to an HMU.

Results from image analysis indicate that all HMU's except for the forb tundra class were discernible through visual interpretation of the EarthSat image. Most of the difficulties associated with image interpretation stemmed from trying to delineate the four tundra habitat classes. Although three of the four tundra HMU's were represented by an image class, the accuracies of these delineations have not been quantified. Clearly, the subalpine shrubland and forested HMU's are the most easily differentiated by visual interpretation of LANDSAT spectral data. Due to the scale used for mapping, and the size and location of the areas occupied by wet sedge meadows, this HMU was the most difficult to delineate on the imagery.

Given that 13 of the 14 HMU's were assigned a unique image class, it is apparent that the methods used in classifying enhanced LANDSAT imagery can result in reliable and representative caribou habitat mapping.

DISCUSSION

An ecologically-based classification sets out to subdivide broad areas into smaller ones in the hope that some generalizations can be made about these mapped subdivisions. The environmental baseline information required to recognize the similarities and the subsequent grouping of landscape features according to their likeness may be acquired through many different approaches. LANDSAT satellite imagery has the advantage of supplying synoptic ecological information from both regional and local perspectives. However, the differentiating criteria for mapping boundaries must be relevant to the objectives of the classification as well as correlated with other significant ecological properties.

The image classes generated from visual interpretation of LANDSAT imagery are designed to serve the purposes of the map users. These image classes include the features which are most significant to the map users and have been selected and interpreted to yield relevant information for the wildlife manager, while maintaining the ecological integrity of each land unit.

In order to utilize the potential information from satellite data, it is necessary to understand the fundamental matter and energy relationships responsible for the images used in analysis and the meaning and nature of the subsequent units used in the classification. The basic underlying premise of using MSS data is that landscape cover types are spectrally separable. However, seasonal changes in vegetation, variations in soil properties and temporal variability of biological systems must be appreciated by the image analyst. It is therefore necessary to understand the factors that influence spectral response patterns as well as the properties of the LANDSAT data. This information will dictate the best time of year to obtain satellite imagery as well as control the themes that characterize a given cover type.

Table 4: Image Interpretation matrix for September 1:250,000 scale enhanced LANDSAT scene (EarthSat Geopic Series K)

Habitat Mapping Unit	LANDSAT Mapping Unit														Image* Class Symbol
	Pink-Brown	Grey-Brown	Red-Brown	Orange-Red	Salmon-Pink	Red-Pink	Magenta	Grey-Magenta	Grey-Green	Grey-Blue	Ice Blue	Dark Blue	Black	Yellow	
Lichen tundra	e														1A
Shrub birch lichen		e													1B
Riparian shrubland			e												1C
Willow forb shrubland				e											1D
Forb tundra					d										4A
Coniferous forest							e								2A
Mixed forest									m						2B
Open lichen woodlands								e							3A
Lichen-heath tundra					m										4A
Tussock grass tundra						e									5A
Sedge-moss tundra					m										5B
Sedge meadow														d	6A
Water bodies											e	e	e		8A 8B 8C
Unvegetated										e					7

Key: Ease of Identification: e = easy; m = moderate; d = difficult
*Image class that corresponds to HMU

The classification table derived for the September image is appropriate for only that time of year. The image classes used for habitat classification would be represented by different spectral signatures on imagery obtained at the peak of the growing season. Therefore, each classification scheme must express the logical and consistent use of explicit criteria for determining mapping boundaries if it is to remain open to critical examination and improvement.

Since MSS data is so highly variable from season to season and from one geographic location to another, the use of visual interpretation techniques as distinct from "automated" computer-assisted techniques remains an important element of LANDSAT image analysis. Furthermore, textural and contextural information is an extremely important source of additional information in classifying LANDSAT data and is only interpretable by humans (Schubert *et al*, 1977).

Our experience has shown that the evaluation, interpretation and classification of satellite imagery still demands that, at the very least, an initial visual interpretation of the data be conducted. Then, when the ecological conditions are suitable and warrant an extension of the classification, a more rapid, digital computer classification can be performed.

An added concern in the use of an exclusive machine classification approach for extending field data is the spectral variations that exist from one LANDSAT scene to another. Extrapolations from field data beyond the scene from which it was collected can be unwise. Each LANDSAT scene must have its own field verification data from which spectral signatures can be classified.

In northern ecological studies where 70 to 80% of the total project budget may be taken up by field expenses (Thie *et al*, 1974; Lands Directorate, 1981) LANDSAT imagery can play a significant role in reducing the costs of habitat classifications. Since a LANDSAT scene provides a broad overview of distinctive patterns of ecological significance, it can be used to stratify the study area into homogeneous map areas and assist in optimizing the gathering of field data. Where ground investigations indicate a uniformity of vegetation and physical features, the number of sampling locations can be greatly reduced and the field data extended over the remaining areas to be mapped. This allows most of the field time to be spent where the data indicates a variation of ecosystem elements within a given vegetation or habitat type. This is an important attribute of using LANDSAT imagery when considering the cost of using a helicopter for sampling and collecting ground truth data.

The results of this study indicate that future field work in the study region should concentrate on more accurately delineating the upland heath complex, tussock grass, forb and sedge-moss tundra habitat types.

The findings of this study are consistent with previous land classification studies conducted in subarctic regions of Canada. Thie *et al* (1974), Kozlovic and Howarth (1977) and Cihlar *et al* (1978) concluded that because subarctic environments demonstrate a close interrelationship between biophysical elements due to their relatively simple ecology and physiography and the lack of disturbing agents (eg fire), visual interpretation of LANDSAT imagery can provide an operational alternative for land classification in arctic and subarctic areas. The close correspondence in this study between the image classes delineated on the enhanced EarthSat image and the Habitat Mapping Units identified in airphotos and field investigations corroborates previous findings.

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AN APPROACH TO HABITAT MANAGEMENT IN THE NORTHWEST TERRITORIES

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ABSTRACT

The development of standardized techniques to systematically study and evaluate wildlife habitat is needed in the Northwest Territories. Ecological land classification procedures can be used to collect the data base required for habitat evaluation.

RÉSUMÉ

Il faut, pour les Territoires du Nord-Ouest, mettre au point des techniques normalisées d'étude et d'évaluation systématiques des habitats fauniques. On peut avoir recours à des méthodes de classification écologique du territoire pour rassembler les données nécessaires à l'évaluation des habitats.

INTRODUCTION

Increased demand for renewable and non-renewable resources in the Northwest Territories has resulted in many land use conflicts, and the lack of a formal planning mechanism has fostered an *ad hoc* approach to resolving these conflicts. In response to the need to resolve conflicting and uncoordinated land use, the Department of Indian Affairs and Northern Development has announced a new policy, which establishes integrated land use planning as a tool to develop land use decisions in the Northwest Territories.

An important component of a northern land use planning exercise must be the inclusion of wildlife and habitat management strategies.

AN APPROACH

Regulating and/or compensating for human use is a key element in the planning of wildlife and habitat management strategies. Conflicts can arise during the allocation of a wildlife resource as a result of inadequate knowledge, temporary and permanent alterations to wildlife populations and habitat resulting from exploration and development, hunting and trapping, and natural change, separately or combined (Donihee and Gray, 1982). Therefore, a major objective of wildlife managers should be to participate in the land use planning process to ensure that wildlife resource/land use conflicts are minimized or eliminated, and when necessary to ensure that compensation programs are enacted.

Successful planning for wildlife and habitat management is contingent upon an adequate data base, and a process to utilize the data base. A great deal of baseline inventory work has been completed in the Northwest Territories; however, the results are variable and in many cases of little practical value for habitat management. Only a few programs now underway (eg., the Northern Land Use Information Series - NLUIS) are designed to provide broad, consistent coverage for the Northwest Territories.

However, the NLUIS program, although useful as a first level indicator of species distribution and habitat, does not facilitate habitat evaluation. Other work (eg., site specific impact assessments) does present more detailed information, but the methods of data collection are not standardized in a manner that facilitates comparison of results between or within areas, and in most cases does not facilitate habitat evaluation.

Given the immense size of the Northwest Territories (3,374,684 km^2) (Fenge *et al*, 1979), it is unlikely that a program to map and describe all of the wildlife habitat and populations at a scale larger than 1:500,000 or 1:250,000 will be initiated. Costs and timing are simply too prohibitive. The answer, therefore, lies with the development of standardized techniques to systematically collect a data base and evaluate wildlife habitat and populations in the Northwest Territories.

This approach will allow resource managers to add information to the existing data base.

What constitutes an adequate data base is difficult to determine because of the great diversity of land/habitat types, wildlife species and resource user needs. However, when planning for wildlife management begins, we maintain that the following factors should be considered:

1) interaction of vegetation, terrain, climate, wildlife species, and hydrology;
2) habitat availability and species abundance;
3) land use; and
4) species adaptability.

The ecological land classification system is one tool that can be used to develop management information for wildlife resources. Biophysical mapping is the ecological basis for land classification. It is a flexible process that can be used to integrate biophysical components on numerous scales (eg., 1:1,000,000 or 1:10,000). This flexibility lends itself to the compilation of generalized information during the early planning stages, and as more information is required on specific sites (eg., critical wildlife habitat), then larger scale maps can be added to the framework. The biophysical land classification data base will not however, serve to answer wildlife resource management questions.

CONCLUSIONS

To make comprehensive land management decisions the land classification system must be used as a data base to identify and describe environmental criteria that can be used to evaluate land as wildlife habitat. Wildlife habitat can be evaluated by determining the principal relationships between wildlife distribution, abundance and behavior, and ecological criteria (eg., vegetation). By integrating the data we can develop a predictive capability to delineate and evaluate wildlife habitat. The Wildlife Service will begin work to develop a standardized approach to studying and evaluating wildlife habitat and populations in the Northwest Territories.

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SUPPORTING THE DETERMINATION OF ARCTIC WILDLIFE HABITATS THROUGH AN ECODISTRICT INFORMATION BASE

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ABSTRACT

Although the Canadian Arctic covers over 2.5 million km^2 (more than one-quarter of the country's surface area), all aspects of its environment are weakly characterized. Despite this generally poor understanding of the Arctic, concerns for the appropriate management of its varied and often abundant wildlife resources have, over the past two decades, maintained a high public profile. As a result, the assessment of arctic wildlife habitats stimulates considerable interest in Canada. To rapidly and inexpensively assess wildlife habitats within large tracts of the Arctic, an ecodistrict approach to information base has been applied. The effectiveness of this approach has evolved around an integrated and holistic land classification. As ecodistricts are hierarchically linked to other ecological generalizations, more detailed or more generalized classes can be presented. Ecodistricts themselves are associated with large-area habitats, and are thus most suitable for regional management.

RÉSUMÉ

Bien que l'Arctique canadien couvre 2.5 millions de kilomètres carrés (plus du quart de la superficie totale du pays), les aspects de son environnement sont faiblement représentés. Malgré cette connaissance généralement insuffisants de l'Artique, le souci d'une gestion convenable de ses ressources fauniques variées et souvent abondantes en a fait un sujet de grand intérêt public au cours des deux dernières décennies. Par conséquent, l'évaluation des habitats fauniques de l'Arctique suscite un grand intérêt au Canada. Pour évaluer rapidement et à peu de frais les habitats fauniques des vastes étendues de l'Arctique, on a recours à une méthode de division par écodistrict pour l'établissement d'une base d'information. L'efficacité de cette méthode tient à une classification intégrée et globaliste des terres. Étant donné que les écodistricts sont liés selon un certain ordre à d'autres généralités écologiques, il est possible de présenter des catégories plus détaillées ou plus générales. Les écodistricts eux-mêmes visent de vastes habitats; ils conviennent donc mieux à la gestion régionale.

INTRODUCTION

The Canadian Arctic covers over 2,500,000 km^2. This is more than one-quarter of Canada's total surface area and more than 60% of the combined area of the Northwest Territories and the Yukon Territory. Despite the immenseness of this area, however, the arctic environment tends to be poorly characterized. This poses a severe hindrance to the preparation of well-founded and comprehensive land use plans. With the current pressures for developing northern energy resources and transporting these materials southerly through the Territories, this information void is a particular and untimely handicap.

THE NORTHERN LAND USE INFORMATION SERIES

The Northern Land Use Information Series of maps, which is sponsored jointly by the federal departments of Environment and Indian and Northern Affairs, was initiated in 1971 to provide generalized baseline information through a rapid and low cost program. The program fosters the collection and compilation of data on the biological, physical, social, cultural, and economic characteristics of the territories. To date, maps have been published for the Yukon Territory and most of the continental Northwest Territories. The project is now operating in the Arctic Islands, most of which

should be mapped by 1988. Information is presented on 1:250,000 scale descriptive maps. This paper addresses two of the types of information presented on the maps -- large area wildlife habitats and ecological units of land. Specifically, it deals with how the delineation and assessment of wildlife habitats is supported in the Northern Land Use Information Series through an approach based on ecodistrict land classification.

HABITAT ASSESSMENT THROUGH AN ECODISTRICT BASE

Habitat has a variety of meanings in the existing literature. Here, it is used to apply to any part of the earth's physical and biological environment which supports or is capable of supporting wildlife. The interpretation of the word is flexible. It can refer to specialized kinds of habitat, such as areas which coincide with caribou calving, fox denning, waterfowl nesting or staging, and so on. Habitat could also be taken in the encompassing sense and include all areas used by a species or by a particular group of species. Depending on the wildlife in question, the total or partial habitat can be very scale related -- some wildlife use small areas and others are far ranging in their needs.

A number of operational constraints have influenced the scope of the word wildlife in the Northern Land Use Information Series as well as the methodologies used for the wildlife and ecodistrict studies. These include:

1. Low budgets and a large study area -- for example, the 1981-82 budget for the wildlife survey was $65,000, almost half of which went for salaries. This left about $35,000 for various field expenses. With a roughly 250,000 km^2 study area, the survey had to be conducted at an average cost of $.14/km^2. The high cost of aircraft charter, accommodation, etc. in remote northern areas allows for only exploratory field surveys.

2. There is only a short time frame for mapping and descriptions. Map lines and descriptions for about thirty map sheets have to be completed within six or seven months of completion of the fieldwork.

3. For most areas, there is a lack of existing baseline data to assist in the work.

Because of these constraints, wildlife surveys in the Northern Land Use Information Series tend to concentrate mainly on the larger and more readily observable animals. These include:

1. Ungulates, such as caribou, muskox, and moose;

2. Carnivores, such as wolf, fox, and bear;

3. Furbearers, such as beaver, muskrat, and otter;

4. Waterfowl, such as geese, ducks, and swans; and

5. Raptors, such as eagles, snowy owl, osprey, and peregrine falcon.

In coastal areas, such as the Arctic islands, seabirds such as gulls, murres, and fulmars are included, but marine mammals are not.

Data on marine mammals (whales, seals, and walrus) are provided by a marine biologist employed or contracted by the Northern Land Use Information Series. Data on fish resources are provided by fisheries biologists employed by the Series.

From independent efforts in the Northern Land Use Information Series program up until 1979, it was observed that most of the habitats mapped by the wildlife biologist coincided primarily with ecodistrict map units. While some wildlife habitats were better suited to more refined or smaller ecological land units and some to more generalized or larger units, many had a close association to ecodistricts.

An <u>ecodistrict</u> is one of several levels of generalization contained within the ecological land classification hierarchy, and is commonly portrayed on map bases of 1:500,000 to 1:250,000. Spatially, ecodistricts average roughly 1,500 to 2,000 km^2 in area, and they commonly range from about 500 to 5,000 km^2. An ecodistrict is currently defined as "an area of land characterized by a distinctive assemblage of relief, geology, geomorphology, vegetation, soils, water, and fauna". In brief, land is viewed holistically and as a natural system. An example is the Old Crow Flats Ecodistrict (Figure 1) which is a largely hydrologically based ecosystem. It is a plain comprised primarily of shallow lakes of various sizes and interstitial organic materials over fine-textured lacustrine deposits. Vegetation on the terrestrial portion of the unit consists

mainly of a continuous cover of sedge-willow-heath-moss tundra or open black spruce taiga with an understory of sedge-heath-willow-moss. The Saneraun Hills Ecodistrict (Figure 2), on the other hand, is a lithologically based ecosystem. It consists of rounded hills of basalt flows over limestone and other sedimentary bedrocks. The hills are characterized by various covers of crustose lichens on upland sites and support a sparse or discontinuous cover of herb-lichen on lower positions. In either case, the inherent make-up of the ecodistrict has implications to wildlife. They each have characteristics which make them favourable or unfavourable for use as wildlife habitats. The methodologies used to delineate and describe ecodistricts and the assessment of these ecodistricts for wildlife habitats are outlined.

Figure 1: Aerial photograph of a representative portion of the Old Crow Flats Ecodistrict.

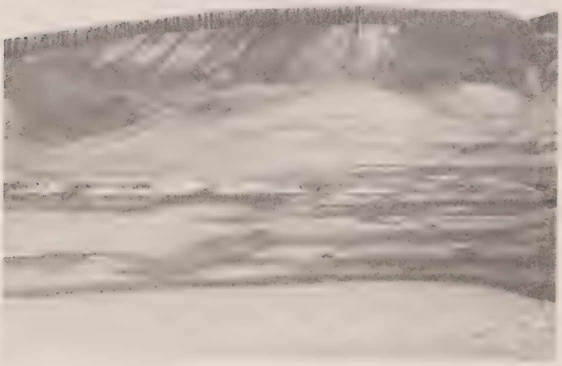


Figure 2: Saneraun Hills Ecodistrict.

EDCODISTRICT LAND CLASSIFICATION

The Ecological Land Classification and Evaluation Division of the Lands Directorate, Environment Canada, provides the ecodistrict information for the Northern Land Use Information Series. This input was initiated during the 1976 field season, and annually 25-30 1:250,000 scale maps and an average area of about 250,000 km^2 are classified for ecodistricts using the ecological land classification approach.

The classification procedure involves three main stages -- the Prefield Stage, the Field Stage, and the Postfield Stage.

The Prefield Stage is aimed at preparing initial boundaries and descriptions of ecodistricts. Background literature, including existing maps of terrain, geology, etc., is collected and reviewed. While usually scarce, this information yields some indication of what to expect within the study area.

LANDSAT Color I transparencies, taken with less than ten percent cloud cover and during the late spring or early summer, are purchased for full coverage of the study area. Map unit boundaries are drawn on mylar sheets which are overlain on the LANDSAT frames. These boundary lines are transferred to a 1:250,000 scale topographical map base, and preliminary descriptions are then made. Selected black-and-white aerial photographs are now consulted to check on or further resolve boundaries depicted through LANDSAT work and to better identify features which are not clear on the LANDSAT. Speed in this procedure is achieved through strip analysis using microfiche collections of aerial photographs.

The LANDSAT and aerial photograph interpretations assist in planning for the Field Stage. By using the information derived from these interpretations, we can optimize our efforts by having fieldwork in representative map units as well as maximizing the number of ecodistricts that we examine in the field.

The Field Stage includes a low-level reconnaissance flight and selected ground checks. To cover the twenty-five to thirty map sheets in a two-to-three week field period requires that ground checks be kept to a minimum. To partly circumvent this problem, we use hand-held 35 mm cameras equipped with a 35 to 105 mm macro-zoom lens and color film for slides.

In low-level reconnaissance flights (150 to 200 m above the ground surface), the slides taken act to supplement field notes. Broad to detailed photographs are taken, and the location and view of each shot are referenced on a 1:250,000 topographic map for later analyses. Because Arctic areas have no forest cover masking the ground surface, low-level flights and the slides enable us to readily identify micro-landforms, frost-induced features, tundra plant communities, and other environmental features. This in part compensates for the lack of numerous ground checks.

The Postfield Stage integrates the findings of the two previous stages. LANDSAT is again examined and the 35 mm color slides are examined in a highly magnified form using a microfiche reader. Much data which were time-wise impossible to record while on flight transects are extracted and related to both the LANDSAT and the pretyped ecodistricts Considering the new data, the ecodistrict boundaries and descriptions are finalized.

WILDLIFE HABITAT ASSESSMENT USING THE ECODISTRICT INFORMATION BASE

The wildlife habitat assessment methodology also involves three main stages.

In the Prefield Stage, literature dealing with wildlife of the area is reviewed and useful information is extracted. Duplicate maps bearing the preliminary ecodistrict boundaries are obtained, and pertinent information is noted for respective map units. Additional information is derived from conversations with scientists and pilots who have worked in the area and from hunters, trappers, and other residents of the area.

The literature review and conversations ensure that work previously done will not be duplicated, and they identify areas of potential importance and where greatest deficiencies occur. LANDSAT transparencies and some aerial photographs are examined to obtain an appreciation for the variation and complexity of terrain in the study area. Pertinent observations are noted on the field maps, and potential habitats are identified.

Fieldwork is now planned so that all map sheets and most ecodistricts can be examined, as well as identified potential habitats within ecodistricts. The fieldwork is virtually limited to the summer period, when weather conditions are best for aircraft operation and the most information can be collected for the least expenditure (ie snow gone from the land so that habitats are more easily distinguishable, and most information on birds can only be observed at this time).

As with the ecodistrict work, the Field Stage includes a reconnaissance flight and selected ground checks. During fairly low-level fixed-wing flights across map sheets, representative portions of ecodistricts are observed along with potential habitats which were identified in the Prefield Stage. Habitat descriptions and wildlife sitings, including population sizes and behaviour, are recorded on the 1:250,000 scale field maps. Selected ground checks involve the investigation of some potential habitats. For example, eskers may be examined in detail on the ground to determine if there are any active or abandoned wolf or Arctic fox dens. Other observations are also noted, such as tracks, browsed vegetation, bones or antlers, droppings, etc. In the Arctic, with the absence of trees and tall shrubs, some of these indicators of wildlife presence are even noticeable during the overflights. Tracks of caribou herds across sedge meadows, along eskers, or even along some hill slopes are readily recognizable, as are antlers of caribou and moose, and skulls of muskox. A lush, green patch of vegetation surrounded by sparser, yellowish or brownish tundra vegetation is often a good indication of an active or recently abandoned den.

Another aspect of the Field Stage which proves valuable is discussions in the field with other researchers, pilots, community residents, fishermen, or anyone else who has recently noted wildlife and can provide population estimates, behavioural patterns, and a geographical location for these. By locating herds of caribou, flocks of waterfowl, active dens, etc. in this way, field time spent looking for these can be reduced and can be devoted to other activities.

In the Postfield Stage, the data gathered in the previous stages are compiled. When the finalized ecodistrict boundaries are received, these data are analyzed to provide an assessment of wildlife habitats on an ecodistrict basis. Many other wildlife data are provided to the compilers of the Northern Land Use Information Series maps. However, only the habitat assessment for ecodistricts will be discussed here.

First of all, characteristic species of each ecodistrict are noted. These are species which may be found in the unit at any time of the year and species which annually use the

area for a certain period. For example, wolf, muskox, or snowy owls may characteristically be found in an ecodistrict during any season, whereas caribou may use the area only for summer range, calving, or winter range, and waterfowl may nest, stage, or molt in it only during a short summer period. Next, specific habitats are discussed for the characteristic species. Depending upon the species and the character of the ecodistrict, all of the unit or only small, scattered portions of it may constitute the habitat. Because of the level of mapping detail, specific habitats cannot be delineated on the map. At this level, it suffices to note that they occur in the ecodistrict. At a later date, if a development is planned for a more limited area, such as a corridor for a pipeline, a more detailed ecological land survey could be carried out to delineate the specific habitats.

INTEGRATION OF WILDLIFE DATA INTO ECODISTRICT DESCRIPTIONS

To indicate how the ecological information is presented in the Ecological Overview portion of Northern Land Use Information Series maps, three distinctly different ecodistricts are described.

Ecodistrict 1 (Figure 3)

The first ecodistrict, occurring in the continental Northwest Territories, is a broad, undulating valley bottom comprised of a blanket or veneer of calcareous, coarse- to medium-textured moraine over noncalcareous, fine-textured marine sediments. Infrequent metamorphic outcrops and outwash deposits are present. Relief is very low (less than 5 m). Soils are actively frost churned and moderately weathered (Brunisolic Turbic Cryosol), with gleyed phases (Gleysolic Turbic Cryosol) present on poorly drained sites. Depth of thaw is generally 0.5-1.0 m.

A discontinuous to continuous cover of arctic avens-sedge, arctic avens-willow, or willow predominates in this ecodistrict. Some locales are nearly barren.

Lakes are mainly shallow and turbid with smooth, rounded shorelines. They are 1-2 km^2 and cover about 10% of the surface. Streams are not entrenched. Density is moderate, with small streams leading to one major, highly turbid river. Flow is northerly and is sustained in summer by influent streams.

The area provides important summer and winter range for barren ground caribou, nesting habitat for a large number of waterfowl, and denning habitat for Arctic fox and wolf.

Ecodistrict 2 (Figures 4 and 5)

The second ecodistrict, occurring on Somerset Island, is a gently rolling plain which is comprised of a blanket or veneer of strongly calcareous, fine- to medium-textured marine sediments and strongly calcareous, coarse-textured moraine over sedimentary

Figure 3: Ecodistrict 1 -- Valley of the Wrottesley River, Boothia Peninsula, continental District of Franklin, N.W.T.

Figure 4: Ecodistrict 2 -- Gently rolling plain of marine and moraine deposit and sedimentary bedrock, south-central Somerset Island, District of Franklin, N.W.T.

bedrock (probably limestone and dolomite). Relief is moderate (20-50 m) and locally rugged along the margins. Soils are actively frost churned and moderately weathered (Brunisolic Turbic Cryosol), with a depth of thaw of generally less than 0.5 m.

Vegetation cover is generally sparse, with purple saxifrage and arctic avens being the main species. A continuous cover of sedge and arctic willow occurs in wet depressions.

Lakes are less than 1 km^2 and cover less than 1% of the surface. They are mostly round, shallow, and slightly turbid. Stream density is low and they display a dendritic pattern. Channels are deeply entrenched near the coast. There is very little summer flow, and waters have a high pH. Flow is southerly or northerly to the coast.

The unit provides year-round range for muskox and summer range for a small number of barren ground caribou, polar bears commonly roam along the coast in summer, some denning habitat is provided for Arctic fox, and a small area along the coast provides nesting habitat for seabirds.

Figure 5: Landsat image (original image at roughly 1:1,000,000 scale) showing the areal extent of Ecodistrict 2, Somerset Island, District of Franklin, N.W.T.

Ecodistrict 3 (Figures 6, 7, and 8)

The third ecodistrict, occurring on northern Baffin Island, is a rugged, highly dissected area of angular mountains which are comprised of metamorphic bedrock. The unit has a high cover of permanent icefields and snowfields. Valleys are broad or narrow and V-shaped, and most valley bottoms are covered with glaciers. Valley sides are steep and steep colluvial slopes are common. Relief is high (greater than 50 m). Soils occur only in isolated sheltered areas.

The ecodistrict is nearly barren. A sparse to very sparse cover of lichens and herbs occurs on some ice-free lowlands.

Lakes are less than 3 km^2 and cover less than 1% of the surface; they are probably ice covered year-round. Streams are limited mainly to the margins of the unit. The density is very low and the channels are poorly developed. Streams are fed by meltwater from icefields and glaciers. Water flow over the ice occurs on many of the glaciers and on a few of the icecaps. Flow is toward the coast.

The unit provides some polar bear denning habitat and summer range, mainly along the coast.

Figure 6: Oblique aerial view of Ecodistrict 3, a rugged, mountainous area on northern Baffin Island, District of Franklin, N.W.T.

Figure 7: Landsat image (original image at about 1:1,000,000 scale) showing a rough delineation of a portion of Ecodistrict 3, Northern Baffin Island, District of Franklin, N.W.T.

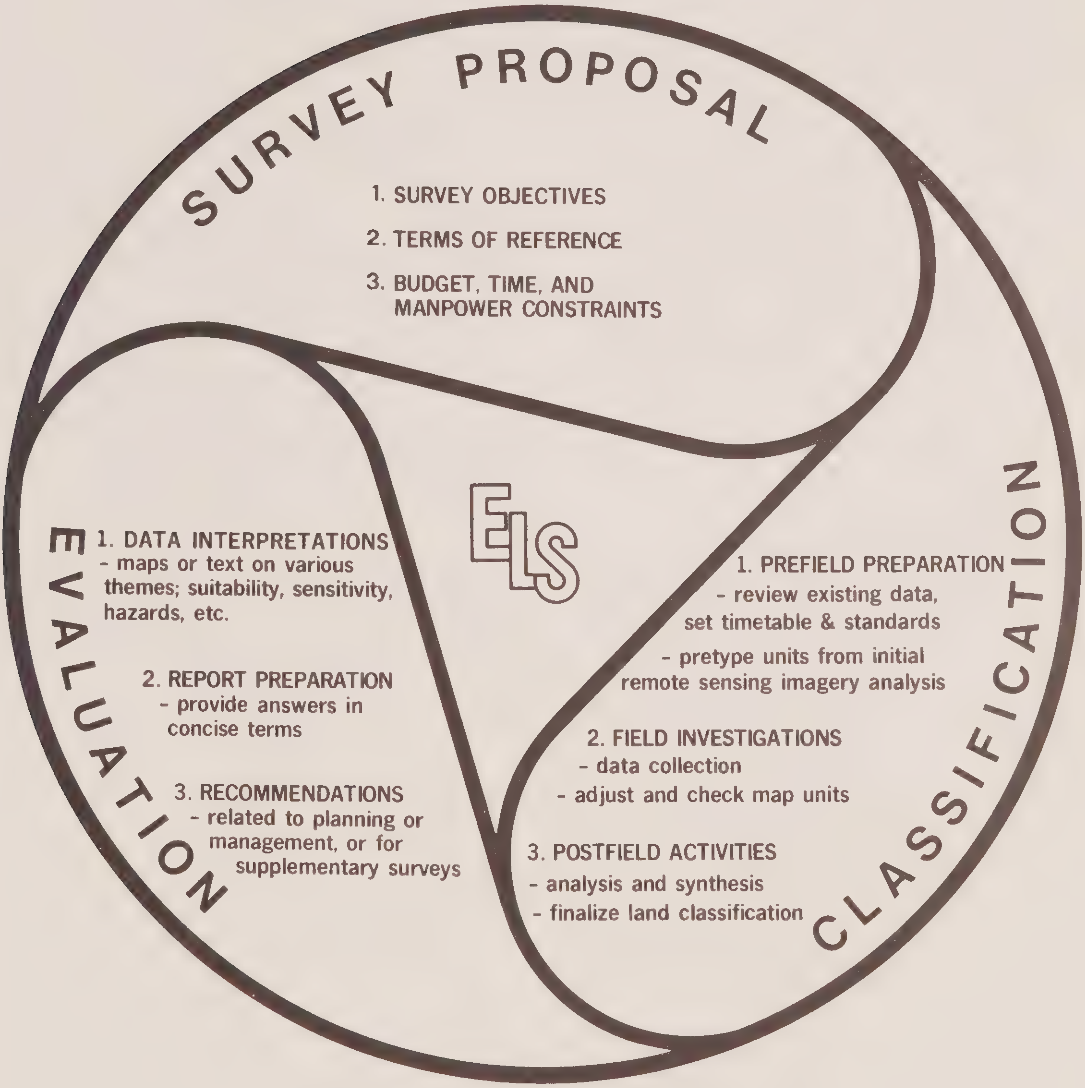
Figure 8: Ecodistrict 3 provides some denning habitat and summer range (mainly along the coast) for polar bear.

SUMMARY

In summary, although both the ecodistrict land classification and the wildlife surveys have to be considered exploratory, the ecodistrict information base is useful for the assessment of wildlife habitats. Ecodistricts themselves may represent wildlife habitats for some species or they may contain wildlife habitats which could be delineated at a more detailed level of mapping. The assessment of wildlife habitats for ecodistricts is providing generalized information which will assist planners in making land use decisions in Canada's Arctic. As more information becomes available through future land and wildlife surveys, it can be added to this ecodistrict base enabling planners to more efficiently evaluate northern lands for potential land uses.

APPENDIX

Major Steps in an Ecological Land Survey



CURRENT VEGETATION COVER CLASSIFICATION AND MAPPING OPTIONS FOR EVALUATION OF WILDLIFE HABITAT IN ALBERTA

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ABSTRACT

Several techniques for interpreting and mapping vegetation cover are examined as to their usefulness in preparing maps suitable for evaluating wildlife habitat at a scale of 1:50,000. The problems and advantages of conventional air photo interpretation, visual and digital analysis of satellite imagery, and the computer graphics generalization of detailed forest cover maps, are discussed.

RÉSUMÉ

Plusieurs techniques d'interprétation et de cartographie du couvert végétal sont examinées quant à leur utilité pour la préparation de cartes permettant d'évaluer les habitats de la faune à l'échelle de 1/50 000. Les problèmes et avantages de l'interprétation classique des photographies aériennes, de l'analyse visuelle et numérique des images fournies par les satellites et de la généralisation infographique des cartes détaillées du couvert forestier sont considérés.

INTRODUCTION

A wildlife habitat inventory methodology and program is currently being developed by the Alberta Fish and Wildlife Division. A primary goal of this program is to provide evaluations of habitat quality at a reconnaissance map scale for extensive portions of the province. Current habitat suitability, in terms of the current ability of an area of land to provide food, cover and space for a wildlife species, is one type of evaluation desired by this program. Vegetation cover at any given point in time is one of the most immediate and important attributes of the landscape in terms of evaluating current habitat suitability. It is also one of the more dynamic and less stable attributes influencing habitat quality as a result of either natural (e.g. fire, windfall, etc) or man-induced (logging, spraying, cultivation, etc) changes.

Several data sources were investigated and tested as a means to achieving 1:50,000 current vegetation cover maps for a wildlife habitat inventory and evaluation pilot project. Data sources had to be recent (within the past 5 years), subject to regular updating, reasonably inexpensive, accessible and manageable in terms of identifying the vegetation cover types desired. A comprehensive vegetation cover classification was developed beforehand which would handle most cover types envisaged to occur within the province, including forested areas, cultivated agricultural lands and common complex patterns of vegetation (Appendix I). The classification is hierarchical in organization so that it has the potential to be used in general reconnaissance inventories as well as detailed studies, and so that it can be more readily integrated with ecological land surveys. First importance is given to vegetation physiognomy (community structure) which subsequently breaks down into more detailed subdivisions based on vegetation composition and species dominance. This classification has been developed with a view to handling all major cover types likely to be encountered in Alberta, including common complex vegetation patterns such as woodland, parkland and groveland. Some of our ideas on physiognomic categories are borrowed from Daubenmire (1968) and Pratt and Gwynne (1977). This classification also parallels in many respects the one proposed by Oswald's paper, presented elsewhere in these proceedings.

STUDY AREA

The pilot project contained two study areas located in south central Alberta (Figure 1). The Buffalo Lake area is typified by agricultural cropland, numerous wetlands and aquatic areas plus scattered fragments of native aspen

Figure 1. Locations of wildlife habitat inventory pilot project study areas.

parkland and groveland. The Rocky Mountain House area is characterized by mixedwood and coniferous forest interspersed with organic wetlands and numerous stream and river valleys.

DATA SOURCES

Two primary data sources were used to achieve total cover mapping of the study areas. These were conventional black and white air photos taken in 1980 at a scale of 1:60,000 and satellite digital data (DICS computer compatible tapes) from 1980 and 1981. A third data source considered for use was visual color composite satellite images. A fourth data source available for much of the Rocky Mountain House area was Alberta Government Phase III Forest Cover Maps at a scale of 1:15,000. This data source was used to test its capability for computer manipulation and mapping of the desired vegetation cover types on two townships.

CONVENTIONAL AIR PHOTO INTERPRETATION

Black and white aerial photography taken in 1980 between April 28 and September 8 at a scale of 1:60,000 was interpreted and used to map vegetation cover. Homogeneous cover units were delineated and labelled using stereoscopic photo interpretation aided by forest cover maps and ground and air field checks. Mapped units were labelled according to the vegetation cover classification (Appendix) and the information was then transferred to 1:50,000 scale N.T.S. paper map sheets (Figure 2). During the transfer process some generalization and complexing of units was made to facilitate final drafting and map presentation at the 1:50,000 map scale.

This photography was reliable for mapping major tree cover types such as deciduous forest, mixedwood forest, spruce-dominated coniferous forest or pine-dominated coniferous forest, as well as the corresponding woodland, parkland and groveland cover types. Shrubland areas could usually be recognized if large and continuous, but they could seldom be subdivided into low or tall types without ground truth or by inference. Herbaceous cover types also could not be recognized in greater detail without ground truth, although native grasslands and meadows were usually distinguishable from improved pastures and hayland by evidence of cultivation patterns. A major problem was in the separation of cultivated perennial grasses (hayland) from annual cropland and this was compounded by frequent changes in the location of these types from year to year as a result of rotational agricultural practises. Muskeg cover types could be reliably interpreted from the air photos, including their classification to the treed, herbaceous/low shrub and mixed categories.

DIGITAL ANALYSIS OF LANDSAT DATA

Landsat digital data in the form of geographically corrected computer compatible tapes (DICS) were analyzed. Data was obtained from July 4, 1981 coverage for the Buffalo Lake area and May 9, 1980 coverage for the Rocky Mountain House area. Four sets of information were interpreted; the raw multispectral data from Bands 5 and 7, as well as two transformations in the form of a Euclidean Distance Transform and a Direction

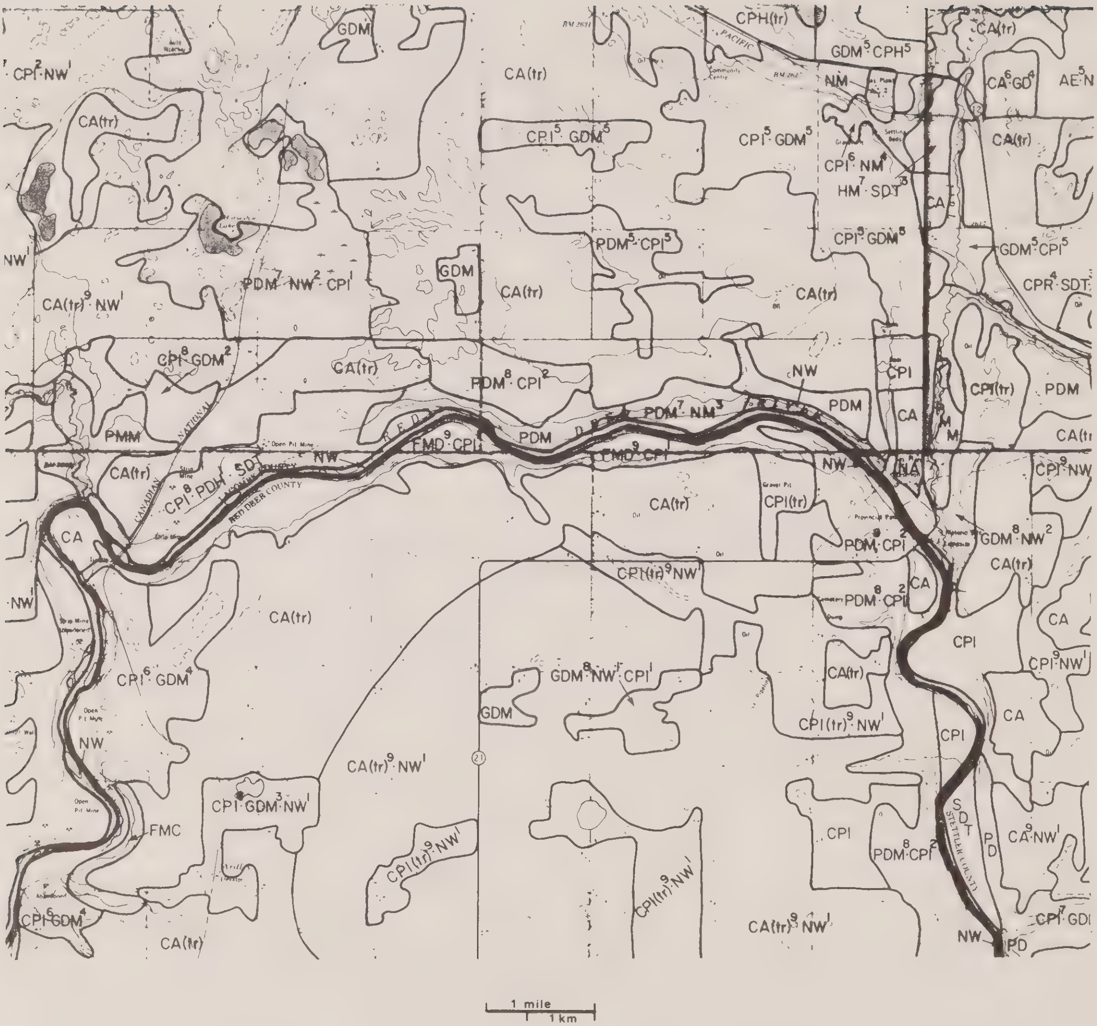

Figure 2. Vegetation cover mapping for wildlife habitat evaluation as prepared from interpretation of 1980 1:60,000 scale B & W air photos. This figure shows a portion of the Alix map sheet (NTS 83A/6) containing the Red Deer River. Refer to the classification legend presented in Appendix I.

Cosine Transform of Band 5 (Donker and Meijerink 1976).

Ground truth information was obtained through the use of preselected training sites. These areas were chosen so as to yield information on large, homogeneous stands (preferably pure) of representative vegetation cover types. The size of each training site was sufficiently large so that a number of ground-truthed cover types occurred contiguous to each other.

A two dimensional feature space indicating the spectral characteristics of each cover type was generated. A supervised, parallelpiped classifier was used to generate a preliminary cover type map. This map was further refined through the use of a cluster analysis where small windows were analyzed (Swain and Davis 1979).

The results of this analysis were mixed with better levels of accuracy obtained for such cover types as: nonvegetated water, nonvegetated soil (e.g. summerfallow), spruce forest and pine forest.

In the Buffalo Lake area problems were encountered in separating low herbaceous cover types, such as hayland, improved pasture, annual cropland and native grassland, from each other. This was caused in part by the early July date of the imagery - a time when vigorous green growth is typical of all these cover types. Landsat data from late May/early June or late August/early September should help to distinguish the annual cropland from both native and tame perennial grasses. Shrub stands were frequently indistinguishable from deciduous tree cover and aquatic emergent vegetation was also difficult to separate from upland herbaceous types.

In the Rocky Mountain House study area there was difficulty in distinguishing deciduous stands from areas of low crown density conifer stands. This problem was greater in the western part of the area where leaf emergence on poplar trees may not have been complete at the time of the imagery. In similar terrain (eg comparable slope steepness and aspect), pine-dominated stands have distinctly higher reflectance values than spruce-dominated stands and were readily separated from each other.

The actual mapping and coding of cover types at the desired 1:50,000 presentation scale required considerable manual interpretation and polygon delineation. Many of the cover types are really mosaics of several pure types, for example parkland and groveland contain complex interspersions of treed and nontreed components. These patterned cover types are best recognized on the most detailed classification of individual pixels, shown at a printout scale of 1:23,300 (Figure 3). Therefore, secondary manual interpretation is required to delineate the desired patterned cover types. Also manual complexing of cover types is required to reduce the map detail to a level suitable for the presentation scale of 1:50,000. If computer generalization is utilized, subdominant components of complex cover types are no longer recognized and valuable information may be lost.

SATELLITE COLOR COMPOSITE IMAGERY INTERPRETATION

Standard color composite satellite images, at scales of 1:100,000, were obtained from the Canada Centre for Remote Sensing in Ottawa. The same Landsat data as used for digital analysis was used to create the visual imagery of the two pilot project areas. Broad units which appeared reasonably uniform in color, tone and texture or pattern were delineated on the imagery. These units were then classified as to their dominant vegetation cover types using ground truth data, air photo interpretation and forest cover maps.

Since the imagery was produced at 1:100,000 scale it lent itself to an initial delineation of cover units which were at a suitable density for map presentation at the 1:50,000 or 1:100,000 scales. However, colors and tones were hazy and not easily separable on the imagery. Also the great complexity of cover types and patterns made their delineation a very subjective process. An even greater amount of field truthing than used in the digital analysis would likely be required for reasonably accurate results. This imagery was a useful visual supplement for orientation with the printouts from digital analysis.

Casual examination of enhanced satellite imagery from the Prince Alberta Satellite Stations, for these same two areas, showed more promise - particularly for small scale (1:100,000 to 1:250,000 scale) vegetation cover mapping. Mid-summer imagery provided the best contrast in forested areas between coniferous and deciduous cover types, whereas in the agricultural areas, distinctions between cultivated fields and native vegetation cover types were clearer on the spring and fall imagery.

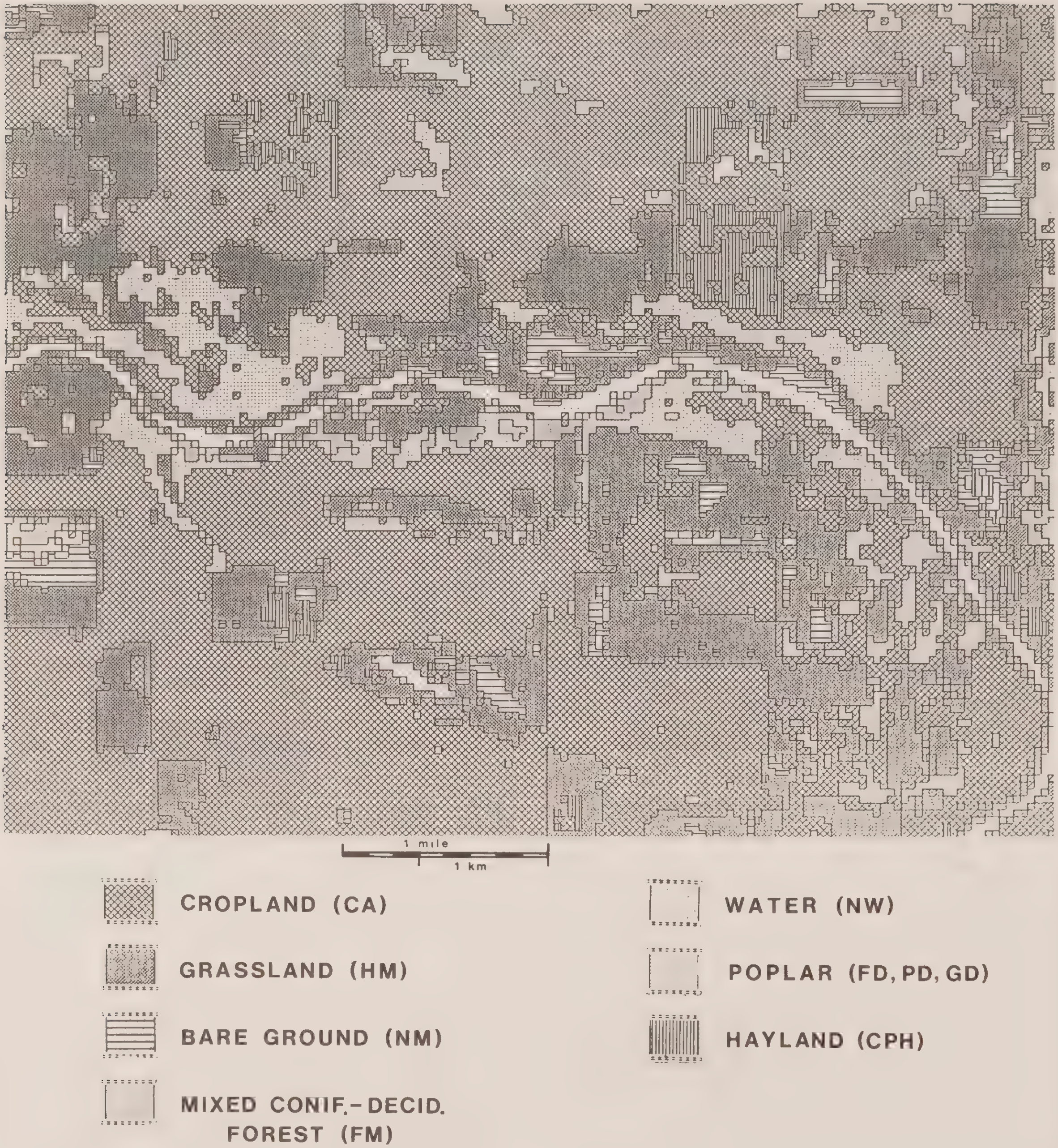

Figure 3. Vegetation cover interpretation from a supervised classification of 1981 Landsat digital data. This figure shows a portion of the Alix map sheet (N.T.S. 83A/6) containing the Red Deer River.

GENERALIZATION OF PHASE III FOREST COVER DATA

Alberta Government Phase III Forest Cover maps of two townships in the Rocky Mountain House study area were selected for computer manipulation. These maps were digitized at their original scale of 1:15,000. Each polygon was recorded with a unique sequence number for future referencing. The digitized map data was converted from polygon to grid mode so that each pixel (smallest unit of data) had a dimension of 50 x 50 metres. This transformation of the data permitted replotting at a scale of 1:23,300 and a generalization of the information to a manageable number of unique cover types which correspond to the vegetation cover types being used by the Wildlife Habitat Inventory Program. Information on stand height, crown density and many other factors related to timber volume and merchantability were eliminated during the generalization process unless they contributed to the interpretation of the established vegetation cover types. An exception was the A crown density (< 30% crown coverage) which was used to distinguish Woodland types from Forest types with B, C, and D crown densities (> 30%). This generalization process was handled by computer programming and resulted in aggregation of pixel data representing like vegetation cover types. The resulting generalized data were converted back to polygon mode and plotted at the desired scale of 1:50,000.

The vegetation cover map which resulted from this generalization was more useable than the original 1:15,000 forest cover maps. There were still problems not related to the computer generalizations, in that the original data was frequently inadequate in the classification of nontreed and nonproductive cover types. Additional photo interpretation and field checking is required to obtain the necessary classification accuracy on these sites when using forest cover maps.

SUMMARY

Landsat data and conventional air photos have somewhat different strengths and weaknesses. They should therefore be used in a complementary fashion and not as substitutes for each other. The handling of several different data sources related to vegetation cover in a given area is useful, particularly in reducing the level of field ground truthing required. However, more attention needs to be given to the development and use of computer graphic systems which can efficiently aid the selective integration and interpretation of these data sources. Extensive field sampling and ground truth is a luxury few of us can still afford and we must look at ways of making better use of readily available data sources.

Vegetation cover classification systems must have sufficient flexibility to utilize different data sources having different levels and kinds of classification accuracy. We feel the system proposed has that flexibility and is suitable for the purposes of reconnaissance wildlife habitat evaluation.

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APPENDIX

VEGETATION COVER CLASSIFICATION FOR WILDLIFE HABITAT INVENTORY

Vegetation Cover Types

A Aquatic
AF - Floating and submerged
AE - Emergent

H Herbaceous non-woody vegetation cover
HM - Mixed grass/forb dominated
HS - Graminoid(sedges and rushes) dominated
HB - Byrophyte(mosses and lichens) dominated

S Shrubland: multiple-stemmed woody vegetation predominates
SL - Low shrubland (< 1 m)
ST - Tall shrubland (>1 m)
SV Variable* low and tall shrubland

R Regenerating Forest over 90% of area is treed with over 30% crown cover and > 6.0m high
RD Deciduous dominated*
RC - Coniferous dominated*
RM Mixed* coniferous and deciduous

*Dominant categories comprise > 80% of the cover type referred to
Mixed or variable categories represent the 20-80% composition range

F Forest over 90% of area is treed with over 30% crown cover and > 6 0m high
FD - Deciduous dominated
FDM - mixed deciduous species
FC Coniferous dominated
FCM - mixed coniferous species
FM Mixed deciduous and coniferous
FMD - deciduous dominated
FMC - coniferous dominated

W Woodland over 90% of area is treed with under 30% crown cover
WD Deciduous dominated
WC - Coniferous dominated
WM Mixed deciduous and coniferous

P Parkland 50% to 90% of area is treed and the non-treed areas are generally unconnected
PD - Deciduous dominated
PDH - herbaceous dominant in non-treed areas
PDS - shrubs dominant in non-treed areas
PDM - mixed herbaceous and shrubs in non-treed areas
PC Coniferous dominated
PCH - herbaceous dominant in non-treed areas
PCS - shrubs dominant in non-treed areas
PCM - mixed herbaceous and shrubs in non-treed areas
PM Mixed deciduous and coniferous
PMH - herbaceous dominant in non-treed areas
PMS - shrubs dominant in non-treed areas
PMM - mixed herbaceous and shrubs in non-treed areas

G Groveland 10% to 50% of area is treed and the treed areas are generally unconnected
GD - Deciduous dominated
GDH - herbaceous dominant in non-treed areas
GDS - shrubs dominant in non-treed areas
GDM - mixed herbaceous and shrubs in non-treed areas
GC - Coniferous dominated
GCH - herbaceous dominant in non-treed areas
GCS - shrubs dominant in non-treed areas
CGM - mixed herbaceous and shrubs in non-treed areas
GM - Mixed deciduous and coniferous
GMH - herbaceous dominant in non-treed areas
GMS - shrubs dominant in non-treed areas
GMM - mixed herbaceous and shrubs in non-treed areas

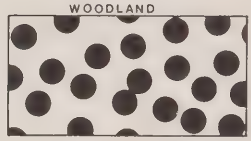
M Muskeg complex vegetation cover types overlying organic soils (organic accumulations 40cm deep)
MT - Tree dominated with over 80% of area supporting some trees
MS - Herbaceous/shrub dominated with less than 20% of area supporting any trees
MM - Mixed tree and herbaceous/shrub area with 20% to 80% of area supporting some trees

C Cultivated
CA - Annual cropland
CI - Irrigated cropland
CP - Perennial forage
CPH - hayland
CPI improved pasture
CPR - rough pasture with native woody component reinvading
CW - Weedy abandoned cropland

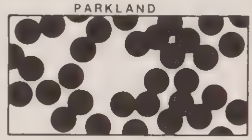
N Non-vegetated
NW Water
NM Mineral
NA Anthropogenic

FOREST

WOODLAND



PARKLAND



GROVELAND

Mapping Conventions

GDM^6 · CPI(tr)^3 · NW^1

10% of the complex is non-vegetated water

30% of the complex is improved pasture with trees present but covering less than 10% of the cover type area

60% of the complex is deciduous dominated groveland with mixed herbaceous and shrubs in non-treed areas

Modifiers to Vegetation Cover Types

Tree Species Dominance

(Sw) - white spruce
(Sb) - black spruce
(Fb) - balsam or alpine fir
(Pi) - lodgepole or jack pine
(Lt) - larch (tamarack)
(Aw) - aspen
(Pb) - balsam poplar
(Bw) - white birch

Maturity

(de) - decadent. climax species becoming decadent
(ma) - mature: climax species dominates canopy
(im) - immature climax species in canopy but not dominant
(re) - regeneration. climax species not present in canopy, or tree cover is less than 50% of mature height

Other

(tr) - trees present but covering less than 10% of unit area
(fo) - forest openings present but covering less than 10% of unit area
(pc) - partial cut
(cc) - clear cut
(bu) burn

MAPPING OF CRITICAL TERRESTRIAL WILDLIFE HABITAT AND WETLAND HABITAT IN SELECTED PORTIONS OF AGRICULTURAL SASKATCHEWAN

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ABSTRACT

Both a Terrestrial Wildlife Habitat Inventory and a Wetland Habitat Inventory have been completed for some portions of agricultural Saskatchewan. The former includes a report and maps illustrating land systems, land use, land tenure, and critical wildlife habitat while the latter contains a report and maps of relative densities of small wetlands, human influences, and key wetland habitat. The primary objective of the inventories, to identify and quantify critical habitat with its preservation and management in mind, has been fulfilled. In addition, these inventories have had extensive use in preparation of the Department of Tourism and Renewable Resources' strategies for the supply and use of wildlife for the 1980's. The objectives and goals for the Wildlife Branch in the 1980's are based to a large degree on the information contained in the Terrestrial Habitat Inventory.

RÉSUMÉ

On a terminé un inventaire des habitats fauniques terrestres et un inventaire des habitats des terres humides pour certains secteurs agricoles de la Saskatchewan. Le premier comporte un rapport et des cartes sur les terres, leurs utilisations, leurs propriétaires et les habitats fauniques de première importance; le second comprend un rapport et des cartes sur les densités relatives des terres humides de faible superficie, sur les influences de l'homme et les principaux habitats fauniques en terres humides. On a atteint le principal objectif des inventaires, à savoir déterminer et quantifier les habitats de première importance, compte tenu de leur conservation et de leur gestion. De plus, ces inventaires ont été beaucoup utilisés pour la préparation des stratégies d'approvisionnement et d'utilisation des stocks fauniques pour les années 80 du ministère du Tourisme et des Richesses renouvelables. Dans une large mesure, les objectifs de la direction de la faune de la province pour les années 80 sont basés sur les informations contenues dans l'inventaire des habitats terrestres.

INTRODUCTION

In 1975 a Terrestrial Wildlife Habitat Inventory (TWHI) of agricultural Saskatchewan was initiated in response to increased pressure on the remaining habitat base by agricultural developments. The purpose of the inventory was to obtain a broader understanding of wildlife-habitat relationships. It provides biophysical, land use, land tenure and critical wildlife habitat information on a 1:250,000 scale for approximately 330,000 km^2 of agricultural Saskatchewan.

The Terrestrial Wildlife Habitat Inventory is 95% finished; only five map areas located along the forest fringe remain to be completed.

Concurrent with the Terrestrial Wildlife Habitat Inventory, a pilot Wetland Habitat Inventory was conducted in 1980 and 1981. This inventory was dependent on the data base and maps produced by the Terrestrial Wildlife Habitat Inventory. Its purpose was to provide information on wildlife-wetland habitat relationships and to identify areas critical for

maintenance of wildlife populations. This project was cost-shared by Gulf Canada Resources Inc., Saskatchewan Oil and Gas Corporation, and Petro-Canada Exploration Incorporated.

These habitat inventories provide the information base which is needed to plan the preservation and management of wildlife habitat in the face of conflicting land uses.

STUDY AREA

Designed in response to increased agricultural development pressures, the study area of the Terrestrial Wildlife Habitat Inventory encompasses all of agricultural Saskatchewan; including 21 full and 5 partial 1:250,000 NTS map sheets (Figure 1). The Wetlands Habitat Inventory, begun in 1980 and completed in 1981 has a much more restricted scope, primarily as a result of the directives originating from funding agencies. Covering only three NTS map areas, 72-N, 73-C, and 73-F, the wetlands inventory was concentrated in the area of heavy oil exploration in northwestern agricultural Saskatchewan.

METHODS AND PRODUCTS

There are four maps and a report produced by the Terrestrial Wildlife Habitat Inventory (TWHI) and three maps and a report by the Wetlands Habitat Inventory for each 1:250,000 NTS map area. The methodology for generating each of these maps differs somewhat. The processes involved in production of the Terrestrial Wildlife Habitat Inventory (TWHI) maps is described in detail in Hart et al. (1979). The first map generated in the series, and the one that acts as a base map for the remaining six, is the Land System Map. Based primarily on soil surveys, geological data and interpretation of 1:80,000 air photos, the Land Systems map illustrates landform and topography according to landscape genesis. Second in the series for the TWHI is the Land Tenure map, illustrating Crown owned versus privately owned lands with the former category being sub-divided into major types of holdings. This information is generated from the files of various government agencies, but primarily that of the Department of Agriculture. The third TWHI map produced for a particular map area is the Land Use map, derived almost entirely from the most recent low-level aerial photography available, although some updating through ground checks and aerial surveys does occur. The final map in the TWHI series is also the most important. This, the Critical Wildlife Habitat map, delineates the best existing habitat within a map area and that essential to maintenance of *current* population levels. Upland game birds and ungulates are of primary consideration although regionally unique, rare or endangered species are also considered as are any vertebrate populations (excluding fish) for which sufficient background data is available. Described in detail in Stelfox (1980), the mapping of critical wildlife habitat is a somewhat subjective process based primarily on population densities and distribution data, species ecology and determined habitat preferences for that particular region. Final delineation of critical wildlife habitat also depends to a large extent on the land system, land use and land tenure data available from the preceding maps. The final product of the TWHI is the report which supplies quantitative and qualitative data, describing land systems, habitat

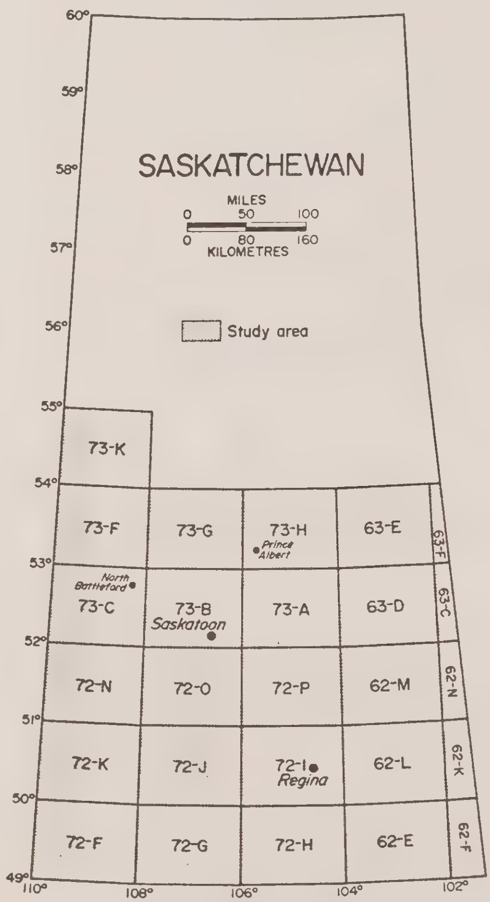

Figure 1: Extent of Terrestrial Wildlife Habitat Inventory.

characteristics and ecological relationships. Information obtained from map area determinations is summarized in tables. These include area of critical wildlife habitat on the map area according to species, according to land systems and according to land tenure categories. Also included are tables which contain the area of land use classes and native vegetation on the map area, area of land tenure categories, area of land systems and estimated area of native vegetation on the map area according to land systems. The report also presents habitat management recommendations in its final section.

The Wetland Habitat Inventory also uses the Land System map as its base map, generating all three of its map products either as overlays or as blue print maps useful as field copies. The first map produced is the Relative Densities of Small Wetlands. Densities are relative rather than actual because they are determined from 1:50,000 NTS maps from which very temporary waterbodies are omitted as are frequently cultivated basins and very small wetlands. However, the map does show a strong correlation between basin density and permanency, and land systems. The second map produced is the Human Influences on Wetlands Habitat showing drainage projects, dams, and improvements. This map is primarily useful in illustrating areas of conflict between agricultural and wildlife interests. Third, and most important in this series is the Key Wildlife Habitat Map for Wetlands, illustrating not only waterbodies important as duck, geese, or swan staging areas, or important as colonial bird nesting sites, but it also indicates areas where a high frequency of waterbodies and adequate upland nesting cover combine to provide critical habitat for upland nesting waterfowl. Also delineated on this map are areas where wetland densities are adequate but upland nesting cover is lacking, limiting the habitat potential. Correlating and explaining the maps is the report which includes quantitative and qualitative data on wetlands and their relationship to land systems, land use and land tenure. Consistent with the format of the TWHI reports, the Wetland Habitat Inventory reports each include a section on habitat management recommendations.

APPLICATIONS AND LIMITATIONS

Over the years, use of the TWHI products has illustrated several areas of limitations. One of particular concern to biologists trying to maintain habitat in a localized area is the fact that although critical habitat is delineated, no acknowledgement is made of habitat which would be classed as fair or good. All of the habitat which can be defined as marginal but which may be necessary in the year-round maintenance of a wildlife population has been ignored in the mapping process although usually mentioned in the reports. This weakens the position of the professionals struggling to maintain this habitat.

A second problem of equal magnitude arises from the fact that although livestock grazing pressure can severely limit or perhaps even destroy the ability of a parcel of land to produce wildlife, there is no mechanism within either the Terrestrial or Wetlands Inventory to isolate parcels of land that have been affected in this manner. Hence, severely overgrazed land may be delineated as critical habitat because visual appearance on aerial photos seemed to warrant it.

Yet another problem that has become apparent over the years is the lack of incorporation of vegetation data into any of the maps. Logistics suggested that since native vegetation is located in small, fragmented blocks and subjected to a variety of influences resulting in a large degree of variability, it would be best dealt with in the report. This is true to a certain extent, but because the NTS map area encompasses approximately 15,000 km^2, a gradient of native vegetation can occur within a land system from south to north or east to west, reducing the correlation between land systems and habitat capability.

Perhaps not precisely a problem with the design of the inventories themselves, it has become apparent to personnel working extensively with the maps and reports that there are numerous permutations and combinations of map overlays possible, making enormous amounts of information available, not all of which has been extracted and incorporated into the reports. Anyone needing information on a particular aspect which is not available in the reports must resort to area calculations from map overlays -- a time consuming process if information is needed for all of the 21 map areas.

One final problem with the TWHI and Wetland Habitat Inventory products is that of updating. The inherent nature of many of the maps produced indicates that periodic updating will be required to maintain their usefulness. So far, this problem has not been dealt with due to time and cost restraints. The possibility of computerization may have to be looked at in the future.

Despite the above-mentioned limitations, the uses found for the Inventory products are legion, many of them unexpected. The primary

purpose of the Inventory was to aid in preservation of remaining wildlife habitat by identifying and quantifying it. Use of inventory products at the field level has proven its value in this respect. However, inventory data has farther reaching implications within the Saskatchewan Department of Tourism and Renewable Resources. Primarily based on the inventory products, the Department has been able to redirect its planning management for the whole province. A major management strategy is being designed which involves identification of supply, demand and use of the various wildlife species. Use of the inventory has also identified problem areas in habitat management. For example, in southeastern Saskatchewan (an area of high white-tailed deer densities), most of the critical habitat occurs on private land. Therefore, in this area of the province there should be priority given to habitat acquisition or maintenance through landowner agreements. Management policies must be entirely different farther north in Saskatchewan where the habitat, although not as productive, occurs primarily on government controlled land. Not only has the Department been able to determine its future directions and goals on the basis of the Inventory, but it also has more guidance for establishment of future research programs.

Also within the Department, the Inventory is utilized by staff members involved in purchasing land for the Wildlife Development Fund. Key habitat which is worthy of purchase has been identified, but also areas void of critical habitat become apparent and can become the focus of land purchase with the aim of habitat improvement.

Most environmental impact assessments currently conducted in Saskatchewan utilize the inventory at least as background data. In many cases the routes of power lines, pipe lines and rail lines have been to some extent determined by the inventory maps. Numerous consultant companies have come to rely heavily on the inventory products to give foundation or baseline information for their site-specific studies.

Another offshoot from the primary objective of the Habitat Inventory is its educational potential. Being an easily understandable visual aid renders it valuable to both primary and secondary school teachers in correlating land form concepts with capability and use.

CONCLUSIONS

Inventories such as the Terrestrial Wildlife Habitat Inventory and the Wetland Habitat Inventory can be of inestimable value to any province or state, lending organization and direction to future land use planning, and habitat preservation and management. However, certain problems which have been identified in this report are inherent in the nature of this type of inventory. These problems must be considered before the initiation of any future inventories and either be accepted as limitations or solved by redesign of the products.

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A PILOT STUDY OF THE APPLICATION OF LANDSAT DATA IN THE MAPPING OF WHITE-TAILED DEER HABITAT IN MANITOBA

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ABSTRACT

*White-tailed deer (*Odocoileus virginianus*) require wooded cover to survive winters as cold as those in Manitoba. In agricultural regions of Manitoba, woodland is being cleared at an alarming rate. This study was conducted to test the feasibility of maintaining an ongoing inventory of wooded cover in south-western Manitoba through the analysis of LANDSAT scenes. The study area was located in the Minnedosa area of Manitoba, and comprised four 1:50,000 map sheets. Two scenes, acquired on 17 June 1979 and 9 September 1980, were used to create LANDSAT thematic maps of the area. The earlier of these maps was used to evaluate the accuracy with which LANDSAT maps measured the area of wooded cover. Aerial photographs (1:15,840) were used to measure real areas of woodland. In 90 sections (approximately 10% of the total study area) the number of hectares of wooded cover per section were measured on aerial photos and LANDSAT maps. A regression of real areas on LANDSAT areas accounted for 80.6% of the variance in real area. The boundaries of the 95% confidence band lie within approximately 10% of the predicted area. The method will become more precise with the use of more sophisticated classification techniques and with the acquisition of more skill in the application of these techniques.*

RÉSUMÉ

*Pour survivre à des hivers aussi froids que ceux du Manitoba, le cerf de virginie (*Odocoileus virginianus*) a besoin de terrains boisés. Dans les régions agricoles de la province, ces terrains sont coupés à un rythme alarmant. Les auteurs ont étudié la possibilité de maintenir un inventaire permanent des terrains boisés dans le sud-ouest du Manitoba par l'analyse des images LANDSAT. La zone étudiée se trouve dans la région de Minnedosa et est couverte par quatre coupures de carte au 1/50 000. Deux images obtenues le 17 juin 1979 et le 9 septembre 1980 ont servi à établir les cartes thématiques LANDSAT de la zone. La carte la plus ancienne a été employée pour contrôler l'exactitude des mesures du territoire boisé fournies par les cartes LANDSAT. Les superficies réelles ont été déterminées à l'aide de photographies aériennes (1/15 840). Dans 90 secteurs (environ 10% de l'étendue étudiée), on a mesuré la superficie en hectares du territoire boisé sur les photographies aériennes et les cartes LANDSAT. Une régression des superficies réelles en fonction des superficies tirées de LANDSAT explique 80,6% de la variance de la superficie réelle. Les limites de l'intervalle de confiance à 95% se situent à moins de 10% environ de la superficie prévue. La précision de la méthode s'améliorera avec l'emploi de techniques plus perfectionnées de classification et au fur et à mesure que l'on deviendra plus compétent dans l'application de ces techniques.*

INTRODUCTION

The Wildlife Branch of the Department of Natural Resources is responsible for the management of white-tailed deer (*Odocoileus virginianus*) in Manitoba. One aspect of this management is the maintenance and development of habitat.

The range of the species within Manitoba comprises approximately 180,000 km^2. In summer, white-tailed deer can be found in almost any habitat within this range, including farm fields, hay meadows, and fringes of cities and towns. However, deer prefer young forest growth, with many openings scattered throughout (Goulden 1981). During the winter, deer require tree cover for shelter and browse. Without the

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shelter of trees, the survival rate for deer is greatly reduced (Hammerstrom, 1939; Gill, 1957; Dasman, 1971; Ozaga and Gysel, 1972). In southwestern Manitoba white-tailed deer winter habitat is made up of treed river valleys, tree-covered sand dunes, clumps of trembling aspen (*Populus tremuloides*) and willow-fringed sloughs, mixed with farmland.

This habitat is currently in serious jeopardy. Agriculture, housing, cottage development, highway and power line corridors, and water reservoirs all contribute to the destruction of wintering habitat. Table 1 shows the losses to agriculture from 1951 to 1974. In the years 1971 to 1979 alone, 10% or 2023 ha of this winter habitat was lost (Goulden, 1981). If losses of this magnitude continue, there will certainly be a serious decline in the size of Manitoba's deer herd. Before the problem can be addressed, however, the wooded cover in agricultural portions of the Province must be mapped and the most critical areas of habitat loss identified.

Table 1: Clearing of unimproved, privately-owned lands. Note that this is all the cleared woodland, not just the woodland which is in large enough blocks to be useful as winter habitat.

PERIOD	AREA CLEARED (km^2)
1951-1955	1274
1956-1960	1054
1961-1965	1707
1966-1970	2896
1971-1974	2121

OBJECTIVES

The objective of the study was to identify a practical technique for measuring white-tailed deer wintering habitat (tree and shrub cover in blocks larger than 16 ha) throughout the provincial deer range. The analysis of LANDSAT digital data has been used successfully in the past to monitor the status of wildlife habitat (George *et al*, 1977; Laperriere *et al*, 1980), and therefore this technique was selected for evaluation. Three important criteria for a satisfactory technique were that it would provide results quickly, economically, and with a minimum of personnel. Our long term goal is to apply such a technique to routine monitoring of the cover available to deer.

STUDY AREA

The study area is located in southwestern Manitoba, approximately 200 km west-northwest of Winnipeg and immediately south of Riding Mountain National Park. The area encompasses six National Topographic Series (NTS) maps of 1:50,000 scale: 62J/3, 4, 5 and 6 and 62 K/1 and 8.

The area was selected for three reasons:
a) the vegetative cover was typical of the provincial deer range.
b) the area contained a variety of geomorphological landforms common to southern Manitoba, and
c) this variety of vegetation and geomorphological features was concentrated so as to be available on one set of LANDSAT Digital Image Correction System (DICS) computer compatible tapes, an area of approximately 82 km by 132 km.

The physiography is the Second Prairie Step region and is composed of undulating ground moraine, sandy deltaic deposits, and level lacustrine deposits.

The area is located in a broad transition zone of Boreal Forest region called the Aspen-Oak section, where forest and prairie become intermixed (Rowe, 1977). Bird (1961) describes the ecology as aspen parkland containing two principal biotic communities: the grassland community and the aspen forest community. The prevalent tree species is trembling aspen. It occurs as small patches ringing wet depressions and as continuous good-growth stands. Trembling aspen usually grows in pure stands except in more moist soils, where it may be associated with balsam poplar (*Populus balsamifera*).

Bur oak (*Quercus macrocarpa*) is found along rivers, on shallow dry soils, and on southwestern slopes of hills and valleys. It is also found mixed with trembling aspen on these sites. On the alluvial flood plain Manitoba maple (*Acer negundo*) is the most common species.

METHODS

Data Acquisition

LANDSAT multispectral scanner (MSS) scenes recorded on 17 June 1979, 22 Aug. 1980, and 9 Sept. 1980 were selected for the study (Table 2). The criteria for selection were:
a) a seasonal date that would be optimal for discriminating between woodland and other types of land use or land cover, and
b) minimal cloud cover.

The product format chosen was DICS computer-compatible tapes. DICS registers LANDSAT digital data to a Universal Transverse Mercator (UTM) projection system. LANDSAT scenes

can then be matched to NTS maps.

Panchromatic aerial photography flown during the summer of 1980, at a scale of 1:15840, was chosen as a source of reference data to determine the accuracy of the LANDSAT data (Table 3). The photography was also used while working interactively on the computer in the classification process and in collecting data on the ground to verify interpretation of photographs.

Table 2: Description of the LANDSAT data selected for this study.

FRAME NUMBER	DATE OF IMAGING
21607 - 16462	17 June 1979
22039 - 16503	22 Aug. 1980
22057 - 16530	9 Sept. 1980

Table 3: Aerial photography data used in this study.

DATE	SCALE	NAPL REFERENCE NUMBERS
1980	1:15840	A25395, A25396
		A25397, A25398
		A25403, A25598

LANDSAT Data Classification

The Ontario Centre for Remote Sensing (OCRS) digital analysis system was used for the pilot study. The system was made available as a part of an ongoing program in technology transfer. It consists of a Norpak RGP 3050 image display subsystem using a DEC PDP 11/34 computer with 64K memory and Applied Resources Image Exploitation System (ARIES) application software, developed by Dipix Systems Ltd. (OCRS, 1980). In addition, the system includes an Applicon colour plotting system to produce colour-coded maps of the digital analysis results.

A LANDSAT digital image classification technique was the approach selected for the analysis. A classified image results when pixels (picture elements which represent units of area 50 m by 50 m) with statistically similar characteristics are grouped into discrete classes. The classification involved an unsupervised clustering algorithm and maximum likelihood (Letts, 1978). The procedure was as follows: A multi-dimensional histogram of the image data was formed. A search was made for the 32 highest peaks, or local maxima in the histogram to give a set of spectral classes (or clusters) identified by their means and standard deviations. Spectral classes were stored in order of significance, determined by the maxima counts, together with the neighbouring counts in each dimension. Each class (maximum) was then individually displayed and evaluated on the monitor. Aerial photography was used to determine which classes were woodland and which were not. The classes from unsupervised classification may not directly correspond to ground classes. Two or more spectral classes may correspond to the same ground class or, alternatively, one spectral class may represent several ground classes (Kalensky *et al*, 1981).

An editing function was applied and spectral classes were either retained, merged, or deleted to a maximum of 16 classes (the limit of the software) which corresponded to ground classes. The result was a generated signature file with corresponding statistics which was then used to classify the entire scene, using a maximum likelihood classifier.

The classified scene was then colour-coded and used to produce LANDSAT colour thematic maps on the Applicon plotting system.

Statistical Analysis

The classification accuracy for the thematic maps produced on the plotter was determined by using the following procedure:

a) Three townships, representing 12% of the study area, and typical of the variation in woodland types, were chosen for analysis.

b) The area of all woodland was then calculated for 90 sections (approximately 10% of the total of 897 sections in the study area) within the three townships. Panchromatic aerial photography at a 1:15840 scale, taken in 1980, was used to identify woodland types. Areas were calculated with a Numonics graphics calculator. These areas were considered to be the real areas of woodland.

c) The same sections were then examined on the LANDSAT colour thematic maps and the total area of woodland per section was calculated.

d) The relationship between the areas from the LANDSAT map and the areas from the photos was analysed with simple linear regression analysis.

Data from all 90 sections were used, including one point which was known to be a field of alfalfa, classified as being a 28 ha block of wooded cover. In routine use of this type of inventory, such fields may be deleted by refining either the timing of the imagery or the sophistication of the statistical methods.

A least-squares simple linear regression was fitted around the points. The LANDSAT areas were the independent variable (x) and the

aerial photo areas were the dependent variable (y).

A 95% confidence interval for the slope of the regression line was calculated as described in Sokal and Rohlf (1969). A 95% confidence band for predicted values of y (real areas) was also calculated (*ibid*).

RESULTS

Of the three dates from which MSS scenes were selected, two (17 June 1979 and 9 Sept. 1980) were used in assembling thematic maps on the plotter, registered on a UTM grid at 1:50,000. Four maps were made: NTS 62 J/3,4,5,6. Only the June scene was used to evaluate the accuracy of the regression technique.

Six themes were generated on the four maps. Five themes represented types of wooded cover, one of them represented water.

In 24% of the sections analysed, there was more woodland on the LANDSAT thematic maps than on the aerial photos. In all cases this overestimation of the amount of wooded area (error of inclusion) was caused by the incorporation of alfalfa crops in the woodland category (J. McKnight, *pers comm*)*.

In 73% of the sections, the real areas were greater than the LANDSAT areas. These errors, errors of omission, were caused by the failure of the classification to include boundary pixels: those pixels in which part of the area was woodland and part was some other cover type. These pixels do not have the same spectral characteristics as pixels which are entirely wooded and therefore are not recognized as wooded cover. Table 4 gives the regression analysis table for the equation:

$$y = 3.32 + 0.859x$$

where y is the real area and x is the LANDSAT area.

The 95% confidence interval for the slope of the regression line is:

maximum slope: 0.948
minimum slope: 0.770

Regression accounts for 80.6% of the variance in $y(r = 0.898)$. The regression equation can therefore be expected to be a useful predictor. The 95% confidence band is relatively narrow: only 4.2 ha wide near the mean values of x (17.7 ha per section) and only 18.7 ha wide when x is 120 ha per section. This converts into a precision of +/- 10.5% for middle values of x and +/- 9% for very large values of x.

Table 4: The regression analysis table relating LANDSAT areas (y) to real areas (x) of wooded cover.

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE
Regression	1	36963	36963	366.25**
Error	88	8881		101
Total	89	45844		

DISCUSSION

The suitability of this technique for routine monitoring appears to be very good. Some large errors will certainly occur when, for example, large forage fields are misclassified, but in many cases the errors will be detected by the first person to look carefully at the map produced by the plotter.

Given that the precision of the work done in this project includes many errors which will be deleted by objective or subjective means in an operational application of the technique, there is every reason to be optimistic about the utility of the method. It would seem reasonable to predict errors of +/- 5% for systems which are operational. It should be mentioned that the systems used in this pilot project only realize their potential when the users spend time in developing skill in operating and interpreting the systems and their results. In establishing an operational program, time must be set aside for careful planning of the project and for the comparison of alternative classifications during the execution of a program.

In the further development of a system for mapping deer habitat in Manitoba, some points require further investigation:

1. Can multiple scenes be used, either simultaneously or in sequence, to decrease the errors in classification?
2. Will a supervised algorithm decrease errors enough to warrant the extra costs of additional ground truthing and training?
3. Can this system be refined to the point where species of trees and shrubs can be identified?
4. What is the minimum woodland area that can be measured using this technique?
5. What are the most feasible options for implementing the use of LANDSAT digital data after the development phase is completed?

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DÉTERMINATION DU POTENTIEL SALMONICOLE D'UNE RIVIÈRE À SAUMON: RIVIÈRE MINGAN, QUÉBEC

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RÉSUMÉ

Dans le cadre d'une étude des rivières à saumon (Salmo Salar L.) de la Côte Nord du Saint-Laurent, une méthode d'inventaire qui a été éprouvée dans plusieurs régions du Québec, a permis d'évaluer le nombre, la superficie et la proportion relative des différents types d'habitats (élevage, reproduction, migration) du saumon atlantique, sur la rivière Mingan. La photographie aérienne est le principal outil de travail; des contrôles au sol (échantillonnage du substrat, relevés hydrologiques, captures de pêches) ont permis d'obtenir la précision de la photo-interprétation, d'évaluer quantitativement les types d'habitats et de définir les caractéristiques biologiques du saumon de cette rivière.

ABSTRACT

Within the framework of Quebec's North Shore salmon (Salmo Salar L.) river studies, a salmonid habitat inventory approach is used for determining the amount, the area and the relative proportion of different habitat types (parr habitat, spawning grounds, migration routes) on the Mingan river. Vertical aerial photography is used in this type of inventory; the information is ground truthed at different homogeneous segments. Substrate samples, hydrological measurements and fish samplings established the accuracy of the photo-interpretation, the quantitative assessment of habitat types, and the biological characteristics of the Mingan river salmon.

INTRODUCTION

Afin de répondre à la demande croissante d'énergie, Hydro-Québec a élaboré un programme d'équipement hydroélectrique qui couvre l'ensemble du territoire québécois. Sur la Côte Nord du Saint-Laurent, ce programme d'équipement prévoit l'aménagement de plusieurs rivières qui supportent actuellement des populations de saumons anadromes.

Devant la valeur de cette ressource biologique et consciente des répercussions que pourrait entraîner une réduction significative des stocks de saumons atlantiques, Hydro-Québec a décidé d'entreprendre une étude globale et intégrée des rivières à saumon de la Côte Nord du Saint-Laurent.

Bien qu'une telle étude comporte plusieurs facettes, ses objectifs ultimes peuvent se résumer de la façon suivante:

1) Déterminer la contribution (c.-à-d. productivité) aux stocks de saumons de chacune des rivières ayant un potentiel hydroélectrique par rapport à l'ensemble des rivières à saumon de la Côte Nord.

2) Constituer un dossier complet sur chacune des rivières à saumon de la Côte Nord et, notamment sur leur utilisation actuelle et potentielle par le saumon, de façon à pouvoir répondre à toutes les questions qu'entraîne l'aménagement hydro-électrique d'un bassin.

3) Évaluer de façon convenable les répercussions du programme d'équipement sur les populations de saumons de ces rivières.

4) Déterminer les moyens à prendre pour sauvegarder et améliorer la productivité du saumon atlantique, afin de répondre de cette ressource vis-à-vis des autorités responsables et de rassurer les populations concernées.

Pour atteindre ces objectifs, la principale tâche consiste à élaborer et à appliquer sur un bassin versant d'une rivière à saumon de la Côte Nord, une méthode d'inventaire et d'analyse pouvant être appliquée à chacune des rivières à saumon de la Côte Nord du Saint-Laurent.

À cet effet, le bassin de la rivière Mingan a été choisi comme zone d'étude. Cette rivière est située sur la moyenne Côte Nord du Saint-Laurent, à proximité des villages de Longue Pointe de Mingan et de Mingan (Figure 1).

FIGURE 1


Bassin versant de la rivière Mingan
PLAN DE SITUATION
ECHELLE
0 25 50 100 180 MILLES
Bassin
DETROIT D'HUDSON
ILE DE BAFFIN
BAIE D'UNGAVA
BAIE D'HUDSON
BAIE JAMES
OCEAN ATLANTIQUE
L A B R A D O R
ILES BELCHER
ILE ANTICOSTI
DETROIT DE JACQUES-CARTIER
GOLFE ST-LAURENT
FLEUVE ST. LAURENT
NOUVEAU-BRUNSWICK
O N T A R I O
ONTARIO
E T A T S - U N I S
T E R R E - N E U V E
DETROIT DE BELLE-ISLE
QUEBEC
MONTREAL
OTTAWA
SEPT ILES
FORT CHIMO
FORT HARRISON
CHUTES CHURCHILL
LAC ONTARIO
ILES-DE-LA MADELEINE
HAVRE ST PIERRE

1) La photographie conventionnelle en noir et blanc à l'échelle 1:15 000, ou idéalement 1:10 000, offre une très bonne identification pour la morphologie du lit et des berges de cours d'eau de même que pour la nature du lit et la dynamique des berges. Toutefois, ce type de photographie, comme tous les autres types utilisés, ne permet pas une identification facile de la nature des berges.

2) La photographie couleur avec filtre polarisant offre la meilleure identification pour la morphologie, la nature et la dynamique du lit. L'échelle idéale qui permet une vision d'ensemble, tout en offrant une bonne résolution serait le 1:12 000. Il est à noter que les essais avec l'infra-rouge fausse couleur ont rendu des clichés contrastés à des profondeurs d'eau inférieures à 1 m pour la dynamique du lit et tout particulièrement pour la détection des nids.

Les campagnes de terrain ont permis de compléter les données obtenues par photo-interprétation. Si l'on compare au Tableau 3, les résultats obtenus par photo-interprétation à ceux des campagnes de terrain, on obtient une efficacité de 93% pour la détection des fosses et des frayères potentielles et une efficacité de 100% pour la détermination des différentes catégories d'aires d'élevage.

Les types d'habitats de saumon atlantique

L'habitat type du tacon sur le bassin de la rivière Mingan est défini par un faciès fluvial à écoulement rapide où le substrat est constitué en grande partie de matériaux grossiers (blocs) de tailles variables. Afin d'obtenir un indice de qualité des aires d'élevage, les segments homogènes du cours d'eau ont été classés en fonction de leur faciès fluvial (Tableau 4). En combinant les valeurs de ces deux paramètres, on obtient une possibilité de trois classes de qualité d'habitats à tacon (Tableau 5). La répartition de ces catégories d'habitat potentiel est présentée au Tableau 6.

La définition d'une frayère potentielle repose principalement sur des critères d'ordre granulométrique, morphologique et hydraulique qui sont déterminés selon les exigences du saumon atlantique et que l'on retrouve dans la littérature. Une distinction a été faite entre une frayère potentielle principale et secondaire. Cette nuance vise à obtenir le plus grand nombre de zones potentielles de reproduction, par le relevé des petites et des grandes superficies d'habitats.

Les cours d'eau de ce bassin disposent d'environ 208 000 m^2 d'habitats potentiels pour la reproduction; de cette superficie, 94% sont accessibles au saumon. La répartition des frayères potentielles est présentée au Tableau 7.

Les captures de pêches

Au total, 209 tacons ont été capturés sur un groupe de 26 stations réparties sur l'ensemble du bassin. Après une première compilation, il semblerait que les meilleurs habitats à tacons se retrouvent dans la partie amont du bassin, dans les branches est et ouest de la rivière Mingan. Ceci apparaît clairement dans le tableau suivant, qui donne les rendements de pêche moyens dans chacun des principaux tronçons du bassin.

Tronçon	Rendement de pêche moyen (prise/heure/ligne)
Rivière Mingan	2,04
Rivière Manitou	0,67
Rivière Mingan ouest	1,63
Rivière Mingan nord-ouest	6,80
Rivière Mingan nord-est	9,00

Les résultats de pêche montrent que le saumon remonte la rivière jusqu'aux obstacles infranchissables situés sur les branches ouest, nord-ouest et nord-est. Le saumon dispose donc d'un territoire long de 145 km.

Bien que de véritables densités n'aient pu être mesurées, les résultats des pêches donnent une idée de l'abondance relative dans chaque catégorie d'habitat. Tous les tacons capturés ont été mesurés, pesés et leur sexe identifié, tandis que la lecture des écailles prélevées sur chacun donnera leur âge. L'ensemble de ces données servira à caractériser la population de tacons de la rivière Mingan. De plus, les estomacs d'une quarantaine de tacons ont été collectionnés, ainsi que ceux d'une quinzaine de truites mouchetées. L'examen des contenus stomacaux permettra de caractériser la diète des tacons et de vérifier s'il y a compétition avec la truite.

À l'aide des données de longueurs et de poids, ainsi que des écailles de tous les saumons adultes capturés par les invités du Club de pêche Mingan Associates, soit un total de 102 individus, il est donc possible de caractériser la population de saumons adultes de la rivière Mingan.

Caractéristiques hydrauliques du bassin

Les relevés effectués au printemps, à l'été et à l'automne 1981 ont permis de déterminer que la rivière Mingan possède un débit modulaire de 60,3 m^3/s. Cette valeur est similaire à celle d'autres bassins de même taille possédant une station de jaugeage sur la Côte Nord. En 1981, ce bassin a subi une forte crue printanière (494 m^3/s) et la période d'étiage a été sévère (10 m^3/s) si l'on compare avec d'autres stations d'enregistrement.

La variation énorme entre les débits de crue et d'étiage se répercute également sur la remontée du coin salin dans l'estuaire. En juin, l'eau salée remonte à peine sur une distance de 1500 m dans l'estuaire, au début août, elle se fait sentir jusqu'à 4000 m de l'embouchure et lors de la crue d'automne, alors que la marée est basse, l'eau salée pénètre à peine dans l'estuaire de la rivière.

Ces conditions ont une influence directe sur l'avalaison des saumoneaux et sur la migration du saumon.

Caractéristiques physico-chimiques du bassin

Suite aux analyses physico-chimiques de l'eau effectuées sur des échantillons provenant des principaux cours d'eau du bassin, on constate qu'elles sont peu alcalines, peu minéralisées, légèrement colorées, bien oxygénées, et que les valeurs varient peu dans le temps.

En moyenne, la température de l'eau sur le bassin est de 8 à 9°C au printemps, elle varie de 16 à 19° C en été, puis baisse graduellement à 4° C en novembre avant l'englacement. D'ordre général, les températures sont 2° C plus basses à la tête du bassin que dans la partie inférieure.

TABLEAU 1

CHEMINEMENT GLOBAL POUR L'ÉTUDE D'UNE RIVIÈRE À SAUMON

CONNAISSANCE GÉNÉRALE DU BASSIN VERSANT

. Climatologie
. Géologie
. Géomorphologie
. Utilisation du sol
. Hydrographie

↓

CONNAISSANCE DES CARACTÉRISTIQUES GÉNÉRALES DE LA RIVIÈRE

. Hydrologie
- Régime hydrologique
- Conditions de glace
- Caractéristiques de l'estuaire

. Hydromorphologie
- Facteurs reliés aux berges
- Facteurs reliés au lit

. Qualité de l'eau et des sédiments
- Physico-chimie de l'eau
- Niveau de contamination des sédiments

↓

CONNAISSANCE DES HABITATS À SAUMON DE LA RIVIÈRE ⇄

. Limites de distribution (obstacles)

. Cartographie et qualité des habitats-types
- Fosses
- Frayères
- Aires d'élevage

↓

ESTIMATION DE LA PRODUCTION ACTUELLE ET DE LA PRODUCTION POTENTIELLE

CONNAISSANCE DE LA BIOLOGIE DU SAUMON

CARACTÉRISTIQUES BIOLOGIQUES

. TACONS:
- Milieux fréquentés
- Diète et croissance
- Facteurs limitatifs
- Mortalité

. ADULTES:
- Montaison
- Caractéristiques biologiques
- Fraie
- Pêche

ESTIMATION DES NOMBRES

. TACONS:
- Densité des tacons par classe d'âge et de longueur
- Superficie des aires d'élevage utilisées et potentielles

. ADULTES:
- Nombre d'adultes sur les frayères
- Fertilité
- Superficie des frayères utilisées et potentielles

RELATIONS INTERSPÉCIFIQUES

. FAUNE ICHTYENNE:
- Ouananiche
- Omble de fontaine
- Truite de mer
- Brochet

. FAUNE AVIENNE

. FAUNE TERRESTRE

FIGURE 2

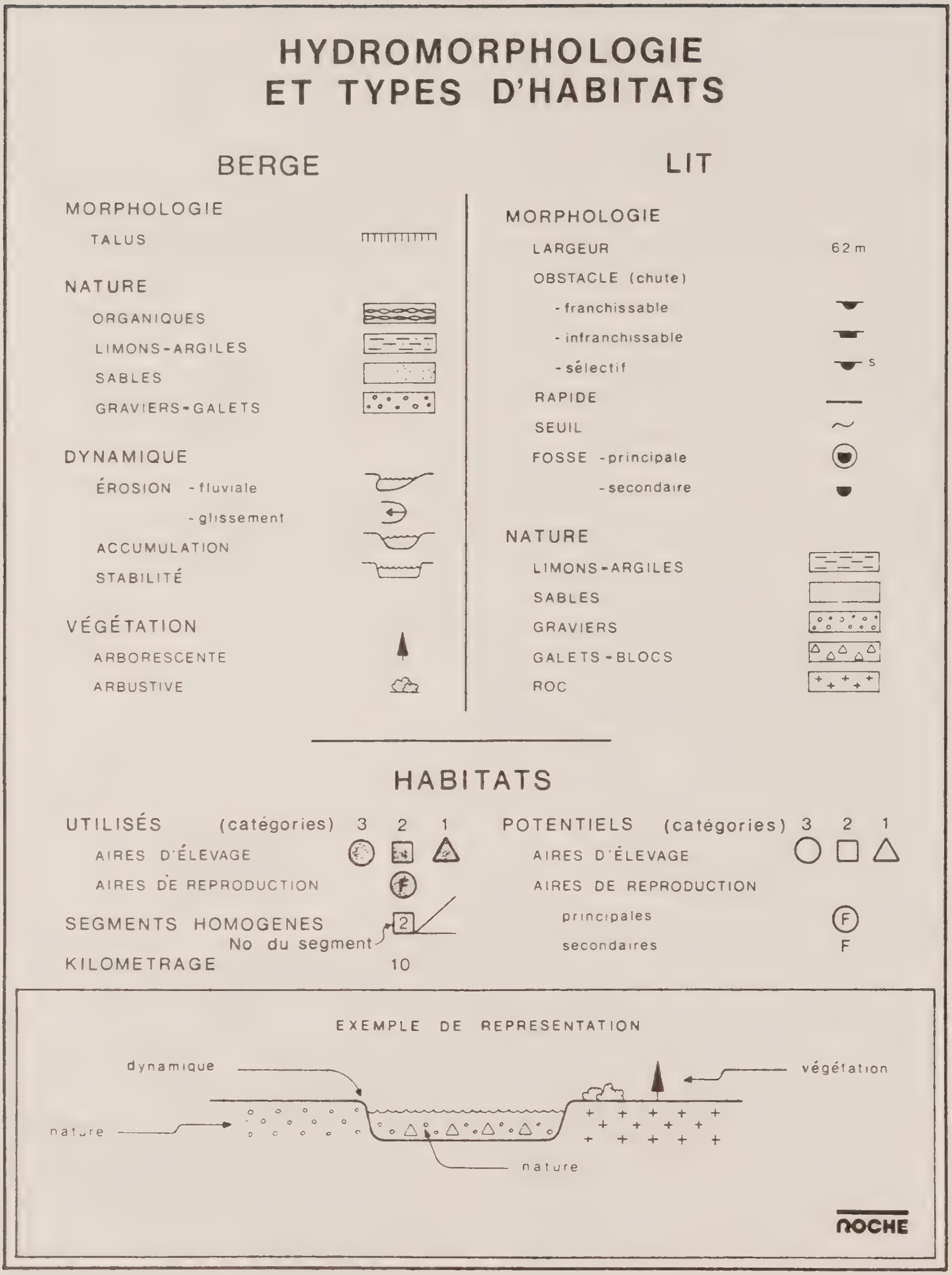
HYDROMORPHOLOGIE
ET TYPES D'HABITATS
BERGE
MORPHOLOGIE
TALUS
NATURE
ORGANIQUES
LIMONS-ARGILES
SABLES
GRAVIERS-GALETS
DYNAMIQUE
ÉROSION - fluviale
- glissement
ACCUMULATION
STABILITÉ
VÉGÉTATION
ARBORESCENTE
ARBUSTIVE
LIT
MORPHOLOGIE
LARGEUR
62 m
OBSTACLE (chute)
- franchissable
- infranchissable
- sélectif
s
RAPIDE
SEUIL
FOSSE - principale
- secondaire
NATURE
LIMONS-ARGILES
SABLES
GRAVIERS
GALETS-BLOCS
ROC
HABITATS
UTILISÉS (catégories) 3 2 1
AIRES D'ÉLEVAGE
AIRES DE REPRODUCTION
SEGMENTS HOMOGENES
2
No du segment
KILOMETRAGE
10
POTENTIELS (catégories) 3 2 1
AIRES D'ÉLEVAGE
AIRES DE REPRODUCTION
principales
F
secondaires
F
EXEMPLE DE REPRESENTATION
dynamique
végétation
nature
nature
ROCHE

FIGURE 3

REPRÉSENTATION GRAPHIQUE CONFORME DES CARACTÉRISTIQUES HYDROMORPHOLOGIQUES

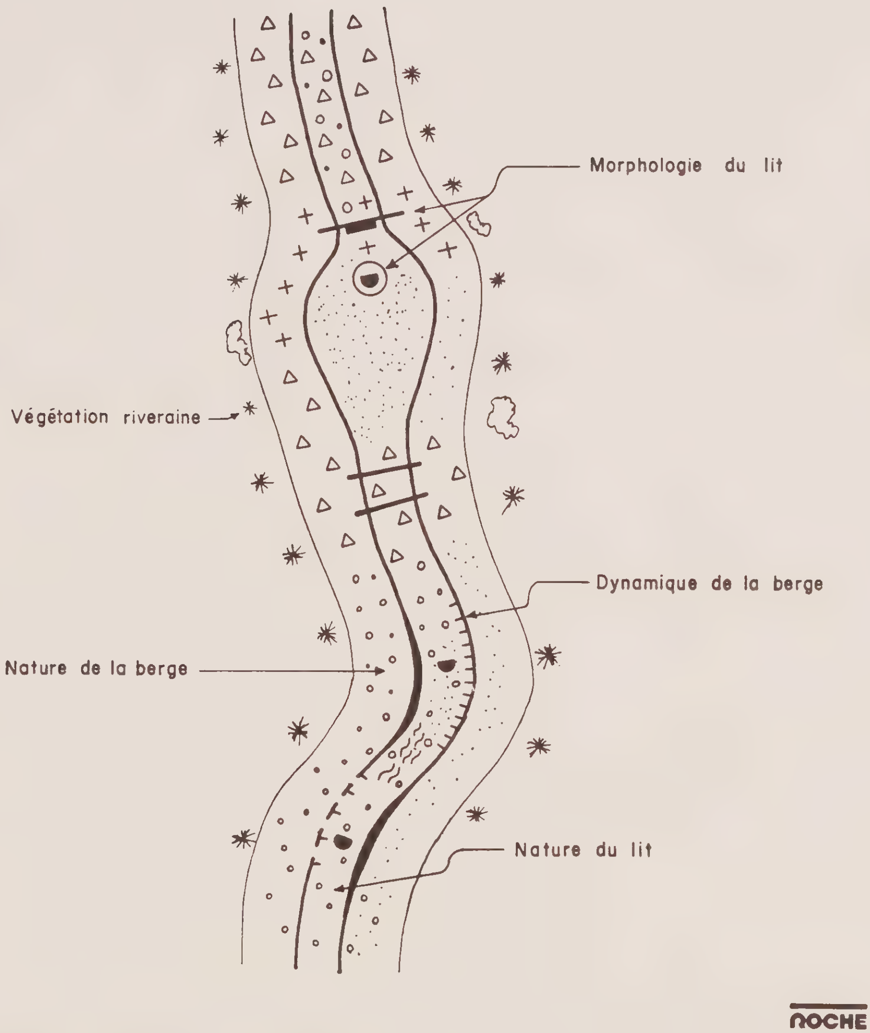

TABLEAU 2: LIMITES DES PHOTOGRAPHIES AÉRIENNES UTILISÉES

EMULSION	TYPE DE FILM	ÉCHELLE	FILTRE	MORPHOLOGIE		NATURE		DYNAMIQUE	
				Lit	Berge	Lit	Berge	Lit	Berge
Noir et blanc Panchromatique	Aérographic	1:15 000	Standard	○	○	○	●	●	○
Couleur	Ektachrome 400	1:12 000	Polarisant	○	●	○	●	○	○
Couleur	Ektachrome 400	1:3 000	Orange	●	●	○	•	○	•
Couleur	Ektachrome 400	1:24 000	Orange	●	•	•	•	●	•
Couleur	Ektachrome 400	1:15 000	Orange	●	•	●	•	●	•
Couleur	Ektachrome 400	1:3 000	Orange-polarisant	○	●	○	●	○	●
Infra-rouge fausse-couleur (250-900 nm)	Ektachrome I.R.	1:15 000	IR-jaune	●	●	•	•	○	●
	Ektachrome I.R.	1:6 000	IR-jaune	●	●	•	•	○	●

○ Facilement identifiable

● Identifiable

• Peu ou pas visible

Son bassin de 2344 km^2 se classe parmi ceux de taille moyenne sur la Côte Nord.

Le choix de cette zone d'étude repose sur sa position géographique ainsi que sur sa possibilité d'aménagement en tant que mesures compensatrices dans le cadre du projet hydroélectrique des rivières Saint-Jean et Romaine.

MÉTHODOLOGIE

Cheminement global pour l'étude d'une rivière à saumon

Dans l'ensemble, le dossier type d'une rivière doit fournir des informations pertinentes sur les sujets suivants:

- caractéristiques générales du bassin versant
- caractéristiques générales de la rivière
- caractéristiques des habitats pour le saumon anadrome
- caractéristiques biologiques de la population de saumons à chaque stade de développement, estimation des nombres et relations interspécifiques
- production actuelle et potentielle.

Le tableau 1 résume le contenu d'un dossier type.

Précisons que la production de saumon d'une rivière est associée ici au nombre de saumoneaux qu'elle produit. Cette production peut être évaluée directement (capture des saumoneaux) ou indirectement, par le biais d'études sur les populations de tacons et les habitats disponibles qui peuvent être utilisés par le saumon: dans les deux cas, on obtient ce qu'on appelle la production potentielle ou accessible de la rivière. Quant à la production potentielle inaccessible, elle correspond à la production supplémentaire que pourrait fournir une rivière si les "habitats potentiels" étaient rendus productifs. Par "habitat potentiel", on désigne tous les habitats théoriquement propices au saumon, qui sont actuellement accessibles ou inaccessibles à cause d'obstacles infranchissables. L'approche pour ce type d'inventaire comprend donc l'utilisation de la photo-interprétation suivie de mesures et de contrôles sur le terrain.

La photo-interprétation

La photographie aérienne noir et blanc produite par le ministère de l'Énergie et des Ressources du Québec constitue le principal document de travail. L'interprétation a été faite par recouvrement stéréoscopique sur 56 paires de photographies à une échelle de 1:15 000. Des essais photographiques à diverses échelles de prise de vue avec des films couleur et infra-rouge fausses couleurs ont été effectués avec un appareil 35 mm afin d'évaluer leur rendement.

La photo-interprétation porte sur les caractéristiques physiques du milieu aquatique, reliées aux berges et au lit du cours d'eau (Figure 2).

La cartographie

La représentation graphique de ces éléments peut prendre deux formes: la première, où l'information est disposée ponctuellement le long du cours d'eau (Figure 3); la seconde, où l'information est regroupée en segments homogènes de cours d'eau, lesquels sont illustrés par des coupes schématiques (Figure 2).

La symbolisation utilisée permet de concevoir une légence multiscalaire pouvant s'appliquer à différentes tailles de cours d'eau. Cette information peut ultérieurement être digitalisée et cartographiée automatiquement.

Les travaux de terrain

Le projet a nécessité trois (3) campagnes de terrain de quinze (15) jours chacune, qui se sont échelonnées de juin à octobre 1981. L'équipe de travail était formée de deux biologistes, un géomorphologue, un ingénieur hydraulicien et un technicien. La campagne du printemps (fin juin) a regroupé les activités suivantes:

- implantation de limnimètres et de stations de jaugeage sur la rivière Manitou et sur la rivière Mingan
- mesures de salinité dans l'estuaire en période de crue et à différentes conditions de marées
- échantillonnage pour la qualité de l'eau sur les principaux cours d'eau du bassin
- échantillonnage de sédiments sur les sites potentiels de reproduction
- vérification des caractéristiques hydromorphologiques levées par photo-interprétation.

Durant la campagne d'été (mi-juillet à mi-août), les travaux suivants ont été effectués:

- jaugeages des rivières Mingan et Manitou en période d'étiage
- mesures de salinité en période d'étiage, et détermination de la limite du coin salin
- essais de pêche électrique et à la ligne pour l'étude de la densité des tacons sur les habitats d'élevage
- captures de tacons et prélèvements (longueur, poids, sexe, écaille, contenus stomacaux)
- prélèvements d'écailles et mesures de longueur et de poids sur des saumons adultes.

Les travaux de terrain de la campagne d'automne (mi-octobre) comprenaient:

- jaugeages aux deux stations limnimétriques et détermination du coin salin dans l'estuaire
- échantillonnages physico-chimiques sur les rivières Mingan et Manitou (température, conductivité, pH, oxygène dissous, transparence, nitrates, orthophosphates, alcalinité et solides totaux dissous)
- description des frayères utilisées par les saumons, et détermination du niveau d'utilisation
- estimation du nombre total de géniteurs sur le bassin de la rivière Mingan
- confirmation sur le terrain des sites potentiels de reproduction relevés par photo-interprétation et qui avaient été visités au printemps
- prises de photographies aériennes couleur et infrarouge couleur, à différentes hauteurs de vol afin de mettre au point une méthode optimale de télédétection pour l'identification de l'habitat du saumon atlantique.

RÉSULTATS

Les limites de la photographie aérienne

Parmi les différentes émulsions photographiques utilisées dans cette étude, deux types de photographie aérienne sont préconisés pour l'inventaire de l'habitat.

Le tableau 2 illustre les différents types de films et de filtres utilisés ainsi que le niveau d'identification des éléments photographiés. Parmi les plus utiles, on retrouve:

TABLEAU 3: RELEVÉ DES TYPES D'HABITATS DU SAUMON

RIVIÈRE	PHOTO-INTERPRÉTATION							TERRAIN ET 2E PHOTO-INTERPRÉTATION						
	Fosses		Frayères		Habitats à tacons			* Fosses		*Frayères		**Habitats à tacons		
	Princ.	Sec.	Princ.	Sec.	I	II	III	Princ.	Sec.	Princ.	Sec.	I	II	III
Mingan	33	75	9	26	4	5	28	35	75	11	28	4	5	28
Manitou	8	22	1	1	2	0	10	8	23	1	1	2	0	10
Nord-Ouest	15	38	4	10	7	6	12	22	47	4	10	7	6	12
Nord-Est	5	24	3	8	3	2	2	5	24	3	9	3	2	2
Ouest	7	9	4	9	6	3	10	7	9	4	10	6	3	10
Total	68	168	21	54	22	16	62	77	178	23	58	22	16	62
Grand total	236		75		100			255		81		100		

Efficacité: Fosses: 93%
Frayères: 93%
Tacons: 100%

* Observations faites par hélicoptère et en plongée, automne 1981

TABLEAU 4 - LÉGENDE DES CARACTÉRISTIQUES PHYSIQUES DES AIRES D'ÉLEVAGE

GRANULOMÉTRIE

R = roc
B = bloc > 203,8 mm
G = galet 76,2 - 203,8 mm
Gg = gravier grossier 30,0 - 76,2 mm
Gm = gravier moyen 16,0 - 30,0 mm
Gf = gravier fin 2,0 - 16,0 mm
S = sable 0,75 - 2,0 mm
A = limons - argiles < 0,075 mm

FACIÈS FLUVIAL

Ra = rapide
Se = seuil
E = chenal
M = méandre
Ba = bassin
E = estuaire

COURS D'EAU

Rivière Mingan: Mi
Rivière Manitou: Ma
Rivière Mingan ouest: O
Rivière Mingan nord-ouest: NO
Rivière Mingan nord-est: NE

TABLEAU 5: ÉVALUATION DES CATÉGORIES D'AIRES D'ÉLEVAGE

RIVIÈRE MINGAN

GRANULOMÉTRIE		FORMATION		SEGMENTS	CATÉGORIE D'AIRES D'ÉLEVAGE
CLASSE	VALEUR	FACIÈS	VALEUR		
R	3	Ra	A	4a(Ma)	III
R + B	1	Ra	A	6(NO), 3(NE),6(NE), 10(Mi), 17(NO), 5(O), 3(Ma)	I
R + S	3	C	Y	2(Mi)	III
B + R	1	Ra	A	15(NO), 13(Mi), 9a(Mi), 17a(Mi), 14(O), 22, 24(NO)	I
B + G + R	1	Ra	A	30(Mi)	I
B	2	Ba	Y	3(O)	III
B + Gg	1	Ra	A	2(O), 4(NO), 4a(NE), 8(Ma) 12(O), 17(O)	I
B + Gg	1	C	Y	10(Ma)	III
G + B + R	1	Se + Ra	A	4(O)	I
G + B + Gg	1	Se	B	2(NO), 5(NO), 4(NE), 21(NO)	II
G + Gg + B	2	Se	B	12(Mi)	II
G + Gg + B	2	M	Y	1(NO), 1(NE), 5(NE), 14(NO)	III
G + Gg	2	C	Y	12(NO), 31(Mi), 20(NO)	III
G + Gg	2	Se	B	13(NO)	II
G + Gg + Gf	2	M + Se	A	1(O)	II
G + Gg + S	3	Se	B	2(Ma), 23 (Mi), 27(Mi),35(Mi) 7(O), 10(O)	III
Gg + G + B	2	C	Y	3(NO), 18(NO)	III
Gg + G + B	2	Se	B	25(Mi), 3(NO)	II
Gg + Gm + S	2	Se	B	22(Mi), 9(Mi), 11(O)	II
Gg + S + Gf	3	Se	B	28(Mi)	III
Gm + S	3	Se + C	Y	7(NO), 24(Mi), 19(NO)	III
Gf + S	3	Se	B	15(Mi), 15(O)	III
S + R	3	Se	B	3(Mi)	III
S + Gg + B	2	M	B	2(NE), 13(O)	II
S + R + Gm	3	Ba + Se	B	7(Mi), 23(NO)	III
S + Gf + R	3	Se	B	18(Mi)	III
S + Gf	3	M	B	8(NO), 19(Mi), 21(Mi), 32(Mi), 34(Mi)	III
S + Gf	3	Se	B	9(NO), 11(NO), 5,11,17,29, 33(Mi), 9(O), 16(O)	III
S	3	M	B	1(Ma)	III
S	3	E	Y	1(Mi)	III
S	3	Se	B	6(Mi), 4(Ma)	III
A + S	3	Se	B	8(Mi) 7(Ma)	III
A + S	3	C	Y	6(Ma)	III
R + B	1	C	Y	16(Mi)	III
R + B	3	Ba	Y	14(Mi)	III
S + Gf	3	C	Y	10(NO), 20(Mi), 26(Mi), 5(Ma), 6(O), 8(O)	III

Valeur granulométrique: 1- Très favorable pour la faune benthique et les tacons
2- Favorable pour la faune benthique et les tacons
3- Peu ou pas favorable pour la faune benthique et les tacons

Valeur de la formation: A- Conditions très favorables à la présence de tacons
B- Conditions peu favorables à la présence de tacons
Y- Absence de tacons

Valeur des aires d'élevage: I- Très bonne qualité, présence de tacons
II- Bonne qualité, présence de tacons
III- Médiocre, peu ou absence de tacons

TABLEAU 6: RÉPARTITION DES HABITATS À TACONS POTENTIELS

HABITAT \ RIVIÈRE	MINGAN	MANITOU	MINGAN N.O.	MINGAN N.E.	MINGAN O.	TOTAL m^2	%
Accessible							
Catégorie I	54 000	4 500	194 000	13 000	42 500	308 000	2,6
Catégorie II	653 000	-	538 000	82 250	45 000	1 318 250	11,5
Catégorie III	5 700 000	394 000	603 000	340 000	9 000	7 046 000	61,5
Inaccessible							
Catégorie I	-	1 125	511 000	25 000	20 300	557 425	4,8
Catégorie II	-	-	12 500	-	57 000	69 500	0,6
Catégorie III	-	7 500	1 700 000	280 000	163 000	2 150 500	18,7

TABLEAU 7: RÉPARTITION DES FRAYÈRES POTENTIELLES

RIVIÈRE / HABITAT	MINGAN	MANITOU	MINGAN N.O.	MINGAN N.E.	MINGAN O.	TOTAL m^2	%
Accessible							
Frayère princ.	85 250	4 500	9 000	-	9 750	108 500	52
Frayère sec.	51 350	-	18 800	17 250	400	87 800	42
Inaccessible							
Frayère princ.	-	1 000	-	2 200	6 000	9 200	5
Frayère sec.	-	200	-	-	2 200	2 400	1

La conductivité est faible sur l'ensemble du bassin, les valeurs varient de 13 à 20 µS/cm. Les valeurs de 5,1 à 6,7 sur l'ensemble des cours d'eau. Le degré de saturation en oxygène dissous se maintient toujours au-dessus de 85%.

La qualité des eaux de ce bassin offre un faible pouvoir de tampon et les rend très vulnérables aux précipitations acides.

CONCLUSION

Bien qu'à ce stade du projet, les résultats soient partiels, il est possible d'envisager une méthode standard d'inventaire d'habitat et d'estimation de la production de tacons, où l'utilisation de la télédétection serait le principal outil de travail. La photographie aérienne panchromatique noir et blanc conventionnelle à l'échelle de 1:15 000 offre une bonne résolution mais l'information recueillie n'est valable que lorsque la prise de vue date de la fin octobre à la fin novembre, soit durant la période de fraie. Par contre, la photographie aérienne couleur avec filtre polarisant prise à une échelle d'environ 1:10 000, durant la période de fraie, offre la meilleure résolution ainsi que des informations plus réalistes.

Bien que de véritables densités n'aient pu être mesurées à ce stade du projet, les résultats de pêche donnent une abondance relative dans chaque type d'habitat. À l'aide des résultats obtenus par télédétection, il est possible d'extrapoler ces abondances relatives sur l'ensemble des cours d'eau du bassin. La production potentielle de tacons peut ainsi être évaluée.

Dans l'ensemble, cette approche nous permet d'accroître considérablement notre connaissance de la population actuelle et potentielle de saumons, de l'habitat, ainsi que des caractéristiques hydrologiques et de la physicochimie de l'eau du bassin de la rivière Mingan.

A PROPOSED VEGETATION CLASSIFICATION SYSTEM FOR CANADA

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ABSTRACT

A system for classifying the vegetation of Canada is proposed. Although it is primarily aimed at satisfying a requirement for Ecological Land Survey, it is structured for classifying the vegetation per se, with no special treatment for any user group. The system consists of six levels of information content, the first four of which are based primarily on physiognomic features and the last two on taxonomy. The basic unit is the plant association (Tier VI) which is defined by the dominant or characteristic species present. Associations are grouped into generalized assemblages of plant species (Tier V) based on dominant species and indicated by not more than three species. These are then grouped into height categories (Tier IV), then according to form (Tier III), then according to density (Tier II) and finally to type (Tier I). Phase modifiers can be used at any Tier or to the entire assemblage to reveal special features or aspects, to incorporate special requirements for a particular user group, to allow further separation within a Tier, etc., but these Phases are currently best defined for local use. The system is primarily designed for use from the top level (Tier I) down as would be done in small-scale classification, but can be used from Tier VI up provided the necessary data on heights and densities are obtained.

RÉSUMÉ

On propose une classification floristique pour le Canada. Même si elle est taillée pour les Relevés écologiques du territoire, elle est tout à fait objective et ne privilégie aucun groupe d'utilisateurs. Elle comporte six niveaux, les quatre premiers fondés avant tout sur l'aspect, les deux derniers sur la taxonomie. L'unité fondamentale en est l'association (niveau VI), qui se définit par l'espèce dominante ou caractéristique. L'association se groupe en alliance (niveau V) d'au plus trois espèces dominantes. Viennent ensuite les catégories de hauteur (niveau IV), de forme (niveau III), de densité (II) et de type (I). A chaque niveau ou pour l'ensemble, on peut faire intervenir des modificateurs de phase, pour mettre en évidence des caractéristiques ou des aspects particuliers, pour répondre aux besoins particuliers d'un groupe d'utilisateurs, pour conférer à un niveau donné davantage de pouvoir de résolution, etc., mais ces phases sont actuellement mieux définies selon les besoins locaux. La classification est principalement conçue pour servir du niveau supérieur (I) vers le bas, comme elle le ferait à petite échelle, mais elle peut servir aussi dans le sens inverse, à condition qu'on possède les renseignements nécessaires sur la hauteur et la densité.

INTRODUCTION

The Canada Committee on Ecological Land Classification is attempting to develop a standardization of vegetation classification for use with Ecological Land Surveys. It would be most advantageous if at the same time the system could have other applications as well. Among the desirable specifications for the system are: 1) it must be holistic for all of Canada, 2) it should be multistructured to allow for different levels of detail (scales of mapping), 3) it should be applicable to remote sensing technology (satellite imagery and aerial photography) to the extent possible. There are additional considerations

as well. Often the people using the system will not have training in phytosociology so that the classification system should be as simple to apply as possible. Most land and resource planners and managers require information on existing vegetation, while the stable or potential vegetation is often more relevant to ELS work; therefore, a system capable of encompassing both is preferential. Furthermore, the vegetation classification system should be independent of any land or climatically based classification system.

This initial classification system is expected to undergo modification as additional information becomes available through reviewing and field testing by a variety of people in different parts of Canada. Therefore, it would be desirable for interested biologists and land surveyors to apply the system in any part of Canada and feel free to express comments and criticisms so that they can be dealt with in future drafts. To aid in evaluation of the system, reviewers may wish to consult other related systems such as Brown, et al. (1980); Carleton, et al. (1977); Fosberg (1967); Layser and Schubert (1979); Paysen, et al. (1980); UNESCO (1973) and Viereck and Dyrness (1980).

The system as proposed is structured for classifying the vegetation per se, with no special features for any particular user group. If the required interpretations can not be made to satisfy user needs, it may be necessary to make certain modifications provided that the modifications are not detrimental to the overall system to the extent the system would be suitable only to one user group. Before any modifications for user requirements are made, the requirements of various user groups must be made known. The divisions, for example, of heights or percent covers could be modified if it is found those indicated have limited value for meaningfully partitioning the vegetation into functional user units, as almost every devised system has different ranges for these parameters.

THE PROPOSED SYSTEM

The system as proposed is structured in a functional manner, beginning with the more easily recognized features of the vegetation that can be interpreted from remote sensing products. Perhaps the most easily recognized feature is the broad type of vegetation, i.e. trees vs shrubs vs herbs, and this distinction forms the first level of the classification system. Vegetation cover, at least in broad percentage classes, is also fairly easy to recognize on the more commonly used scales of aerial photography, and this forms the second level of information. The system proceeds through other parameters to the point where the data, by and large, must be obtained from on-site examination. Names for the different levels of information have been dispensed with for the time being because of the confusion that may exist among other systems, due largely to lack of consistent usage; rather the levels are referred to as "Tiers". The system, strictly speaking, is not entirely hierarchical, because some Tiers are not dependent on Tiers above or below them.

The classification system has six tiers with an optional seventh category that may be used to add specific information to any tier. The first four Tiers (I,II,III and IV) are based for the most part on physiognomy or appearance of the vegetation and the lower two (Tiers V and VI) on taxonomy. Tier VI constitutes the basic unit of the system, and is intended to be an association according to the concepts of Braun-Blanquet (See Whittaker 1978).

Tier I - refers to the broad physiognomic divisions of vegetation, namely Trees, Shrubs and Herbs.

Tier II - indicates the coverage of the vegetation as estimated by percentage classes through the vertical projection of a particular synusia or layer onto the ground surface; Closed, Open, Dispersed, Bunched and Sparse.

Tier III - provides a division within the dominant layer as to the type of vegetation composing the layer; e.g. Softwood, Hardwood or Mixedwood for trees; Nonevergreen or Evergreen for shrubs; Grass, Graminoid, Forb, Moss or Lichen for herbs.

Tier IV - indicates the height categories as considered appropriate for each type of vegetation.

Tier V - a general assemblage of plants that occurs, or has the potential of occurring, on the landscape; although it is preferential to indicate both a dominant overstory and a dominant or characteristic understory species, the overstory can be indicated alone if the understory is not known.

Tier VI - an association in the Braun-Blanquet sense; the basic unit of the classification system, defined by the species present and must include the dominant, co-dominant or indicator species in each layer or synusia comprising the vegetation.

Phase - not a level in the system per se, but can be used as necessary at any Tier to further partition the vegetation, e.g. it could be used to indicate more refined height separations, densities, maturity classes, disturbances, etc., or to indicate aspects of the vegetation necessary to satisfy specific user requirements. For the time being at least, it is perhaps best to leave the Phase modifiers undefined until they have been explored on a local basis in various parts of Canada and for a variety of uses.

The proposed classification system is outlined below, with definitions given where appropriate. The categories are preceded by a letter or number that could be used for symboling units. Diagrams are given to illustrate some features, such as percent coverages.

Tier I - T. Trees: any single-stemmed woody plant; generally refers to plants greater than 5 m in height, but also includes young or environmentally controlled members of tree species less than 5 m in height.

Tier II:

- c. Closed: tree cover greater than 70%; branches often touching or overlapping (Fig. 1).
- o. Open: tree cover 41-70%; branches rarely touching (Fig. 2).
- d. Dispersed: scattered; tree cover 10-40%; distribution fairly uniform over area (Fig. 3).
- b. Bunched: clumped; tree cover 10-40%; trees occur in clusters separated by non-treed areas (Fig. 4).
- u. Sparse: tree cover less than 10% (Fig. 5).

Tier III.

- S. Softwood: any gymnosperm (conifer) tree; mostly all evergreen, except larch, and are linear or needle leafed.

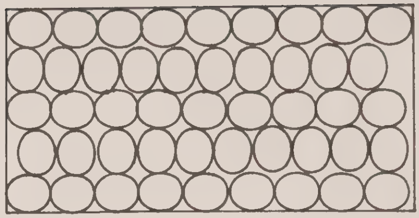

Figure 1. Illustration of about 70% cover.

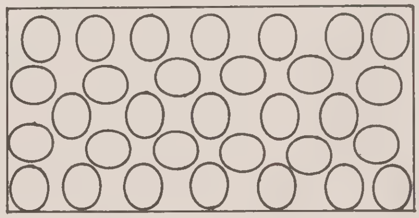

Figure 2. Illustration of about 45% cover.

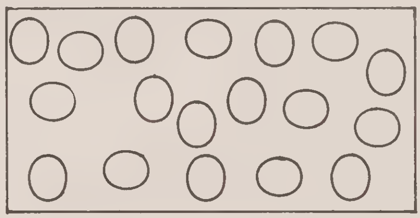

Figure 3. Illustration of about 25% cover with dispersed distribution.

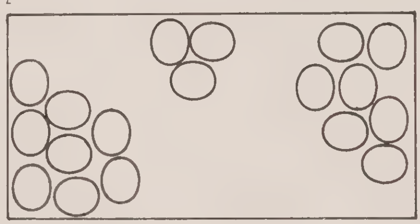

Figure 4. Illustration of about 25% cover with bunched distribution.

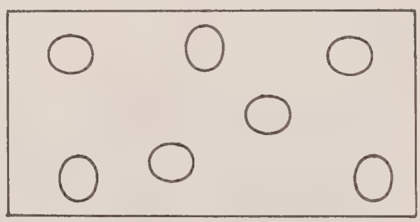

Figure 5. Illustration of about 10% cover.

H. Hardwood: Any angiosperm tree; mostly all deciduous, except arbutus, and are narrow to broad leafed.
M. Mixedwood: combinations of softwood and hardwood where each contributes 25% or more of the tree cover.

Tier IV:
t. Tall: trees over 30 m in height.
m. Mid: trees 16 to 30 m in height.
l. Low: trees 5 to 15 m in height.
d. Dwarf: trees less than 5 m in height; will include young regeneration as well as trees genetically or environmentally controlled to less than 5 m in height.

Tier V: (examples only)
WS*/fm -- White spruce/feathermoss
BS/sb -- Black spruce/shrub birch
WS-BS/w -- White spruce - Black spruce/willow
WS-TA/gr -- White spruce - Aspen/grass
LP-TA/w/gr -- Lodgepole pine - Aspen/willow/grass

Tier VI: (Examples only; for the time being at least, they can be referred to numerically.)
1. Picea glauca/Betula glandulosa - Vaccinium uliginosum/Hylocomium splendens.
2. Picea glauca - P. mariana/Salix glauca - Betula glandulosa/Tomenthypnum nitens - Aulacomnium palustre.
3. Pinus contorta/Cladina mitis - C. stellaris - C. rangiferina.
4. Populus tremuloides/Alnus crispa/Hylocomium splendens - Pleurozium schreberi - Ptilium crista-castrensis.

Tier I - S. Shrubs: multistemmed woody plants

Tier II:
c. Closed: shrub cover greater than 70%.
o. Open: shrub cover 41-70%.
d. Dispersed: shrub cover 10-40%, distribution fairly uniform.
b. Bunched: shrub cover 10-40%, shrubs occurring in clusters.
u. Sparse: shrub cover less than 10%.

Tier III: (only tentative groups indicated; perhaps other groupings would be more meaningful.)
N. Nonevergreen: deciduous shrubs.
E. Evergreen: shrubs whose leaves remain green all year.
M. Mixed: evergreen and nonevergreen.

Tier IV:
t. Tall: shrubs greater than 1.5 m in height.
m. Mid: shrubs 0.5 to 1.5 m in height.
l. Low: shrubs 0.2 to less than 0.5 in height.
d. Dwarf: shrubs less than 0.2 m in height.

Tier V: (examples only)
Sb/li -- Shrub birch/lichen
Al/fm -- Alder/feathermoss
Sb-w/bm -- Shrub birch-Willow/bog (brown) moss

Tier VI: (examples only)
1. Salix glauca - Betula glandulosa/Cetraria nivalis-Cladina mitis - Thamnolia vermicularis
2. Vaccinium ulginiosum - Potentilla fruticosa/Carex microchaeta-C. vaginata/Drepanocladus uncinatis

Tier I - H. Herbs: any non-woody plant; the so-called "semi-shrubs" such as Bunchberry, Dogbane and Poison ivy may be included.

Tier II:
c. Closed: herbs providing more than 70% cover.
o. Open: herbs providing 41-70% cover.
d. Dispersed: herbs providing 10-40% cover, distribution fairly uniform.
b. Bunched: herbs providing 10-40% cover, distribution clumped.
u. Sparse: herbs providing less than 10% cover.

Tier III:
P. Grass: any member of the Gramineae (Poaceae) family.
G. Graminoid: any of the grass-like plants not in the Gramineae family; includes Sparganiaceae, Cyperaceae, Juncaceae, etc.
F. Forbs: any broad to narrow leafed vascular plants not in the above categories.

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* For standard tree symbols see Bonner (1976).

Tier IV:
- t. Tall: plants greater than 1 m in height.
- m. Mid: plants 0.5 - 1 m in height.
- l. Low: plants 0.1 to less than 0.5 m in height.
- d. Dwarf: plants less than 0.1 m in height; refers only to the green portion in Sphagnum for example, which can have a long strand of old growth.

Tier V: (examples only)
- Gr/Li -- Grass/lichen
- Se/Bm -- Sedge/brown moss
- Gr-Fo -- Grass-Forb (a meadow for example)

Tier VI: (examples only)
1. Stereocaulon tomentosum - Cetraria nivalis
2. Carex aquatilis - Drepanocladus uncinatus - Fontinalis antipyretica
3. Calamagrostis canadensis - Trisetum spicatum - Aconitum delphinifolium - Claytonia sarmentosa - Cetraria nivalis.

Tier I-N. Nonvasculars: plants lacking a specialized conducting system which includes xylem and phloem.

Tier II:
- c. Closed: nonvascular plants providing more than 70% cover.
- o. Open: nonvascular plants providing 41-70% cover.
- d. Dispersed: nonvascular plants providing 10-40% cover, distribution fairly uniform.
- b. Bunched: nonvascular plants providing 10-40% cover, distribution clumped.
- u. Sparse: nonvascular plants providing less than 10% cover.

Tier III:
- A. Algae: mostly aquatic plants
- B. Bryophytes: includes moss, sphagnum and liverworts
- L. Lichen: any lichen.

Tier IV:
- t. Tall: plants greater than 0.1 m in height
- m. Mid: plants 0.05-0.1 m tall
- l. Low: plants 0.01-0.05 m tall
- d. Dwarf: plants less than 0.01 m tall.

Tier V: (examples only)
- Li-Fm - lichen-feathermoss
- Sh-Se - Sphagnum-sedge

Tier VI: (examples only)
1. Peltigera aphthosa - Cladina mitis - Hylocomium splendens - Pleurozium schreberi
2. Sphagnum rubellum - S. capillaceum - Drepanocladus uncinatus - Carex aquatilis.

As with most systems, there is a bias toward woody plants, trees in particular; this is an inheritance that is difficult to avoid. There are several reasons for this disparity, e.g. 1) it is easier to see trees on aerial photographs, aircraft fly-overs or from the road, 2) more people are more familiar with trees due to their size and that there are fewer and more easily recognized species, and 3) trees have a significant influence on other vegetation of a site due to their size and the effect they have on modifying the micro-environment surrounding them. Consequently, a piece of landscape with, say 15% tree cover, would be classed as a treed landscape even if 60% ground cover was provided by Alnus crispa. It is recommended that any area with less than 10% tree cover, the Sparse category, be classed as Shrub or Herbs as the case may be, provided that one of these classes provides more than 10% ground cover. A similar situation would exist with shrubs in the absence of trees.

The percent cover as used in this system refers to the vertical projection of a particular form or class of the vegetation onto the ground surface. For example, when estimating the tree cover, it is the percentage of ground area covered by the vertical projection of all the trees under consideration; it has no bearing on any other layer or class of vegetation, nor to the tree species composition. Likewise, if the desired datum was the amount of shrub cover, the total assemblage of shrubs under consideration would be viewed in their entirety even if some occurred under trees. In the case where the interest is in relation to the total vegetation, the percent of tree cover plus the percent of shrub cover plus the percent of herb cover must equal 100% even if the total vegetation cover is say 80%; similarly, the composition of one layer can be broken down by component parts, e.g. a stand of trees with 60% cover may be composed of 40% white spruce, 40% black spruce and 20% birch and can be expressed as 40/60, 40/60 and 20/60 respectively.

LEGEND CONSTRUCTION

Using the letters indicated for the Tier categories, a symbol can be expressed as follows:

```
Tier II ──────┐ ┌────── Tier III
Tier I ─────┐ │ │ ┌──── Tier IV
            TcSm
         ──────────
         ws/w/fm(1)
Tier V ──────┘   └───── Tier VI
```

This example indicates trees providing more than 70% cover, that are more than 75% softwood and are 16-30 m tall; the dominant tree species is white spruce with a recognizable willow layer and a feathermoss ground cover. Reference is given to the Tier VI (association) description which would have to be included in the legend or text.

If additional separations were made in any Tier through the use of the Phase category, it could be added as a super- or sub-script to the particular Tier as appropriate. In the case where a modifier applied to the entire community rather than a specific Tier, as may arise for example if a landscape modifier such as alpine, subalpine, aquatic, etc. was desired, it could be placed directly to the left of the line separating the physiognomic from the taxonomic information.

At commonly used ELS mapping scales, 1:100,000 or smaller, any delineated polygon will likely have more than one community, even at Tier I. A possible means of handling such situations would be to indicate up to three of the most prevalent types and show a percentage of area covered by each with a number e.g. $\frac{\text{ToSm}}{\text{WS/fm}}\ 5$, $\frac{\text{ScNm}}{\text{Sb-W/li}}\ 3$, $\frac{\text{HoPl}}{\text{Gr-li}}\ 2$. Alternatively, a symbolization, such as is used in surficial material designators, could be worked out using slash and equal signs.

DISCUSSION

A third taxonomic tier, equivalent to the Series in such systems as Paysen, et al. (1980) and Layser and Schubert (1979), was considered and may be introduced later. After consideration of the problems associated with using it correctly by non-phytosociologists, it is currently omitted. It would consist of indicating a single species, or possibly two closely allied species of the same synusia or layer, that is (are) indicative of a particular set of environmental conditions. This would not necessarily be the dominant species; for example, western hemlock has a fairly wide ecological amplitude in coastal forests and can dominate all but the driest forests. However, associated tree species often indicate a narrower range of site conditions and, therefore, the Sitka spruce, yellow cedar, western red cedar, amabilis fir and Douglas fir series could occur in western hemlock dominated stands. Also, a piece of the landscape may occur in a particular Series even though the diagnostic species may not be present, such as may happen in early successional cases. If the Series were named after successional species, then at least a third of the known plant species could form a Series and there would be little meaning to the category other than that a certain species was dominant which would be indicated at Tier V and VI anyway.

The term "community" is often used as a general term to refer to any assemblage of plant species growing together at nearly any level of generalization. Since it is often convenient to have such a term in a vegetation classification system, it is proposed that "community" can be used for any assemblage referred to from Tier I to Tier V. Tier VI categories should be defined in the sense of the Braun-Blanquet terminology and be referred to as an "association". To some people, an association is an abstract term, but for our purposes it must refer to a real entity, even though it may be a successional stage.

In applying the system, the amount of information (the level in the system) provided will depend in part on the scale of mapping, on the method of survey and on the amount of ground observation. Using satellite imagery with limited field checking, it may be possible to indicate Tier I or part of Tier II; it may be possible to recognize Tier III categories for trees but not for shrubs or herbs. More information can be obtained from aerial photographs, but the level to which vegetation can be assessed will depend on a host of factors, such as scale of photography, type of film (true color, color IR, B/WIR, panchromatic, etc.) and quality of photography. Tier VI categories can normally only be described from on-site examination, but can often be extrapolated to other areas if the aerial photography and knowledge of the area are adequate. Encouragement is given to applying the system to the extent possible by a variety of means, and perhaps problems can be worked out as the vegetation classification system develops.

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SUMMARY OF HABITAT INVENTORY USER NEEDS AND QUESTIONNAIRE RESULTS IN ALBERTA

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ABSTRACT

Summarized results of a questionnaire sent to various potential users of fish and wildlife habitat inventory information in Alberta are presented. Identified information requirements varied substantially in scale of detail and content, depending on user needs and the problems to be addressed. Nearly all respondents (96%) wanted habitat inventory data on game species, whereas only 40% were interested in non-game species. Clearly no single habitat inventory methodology could hope to meet the majority of all user requirements. A better clarification of inventory methodologies designed to meet specific applications is needed.

RÉSUMÉ

Voici les résultats résumés d'un questionnaire envoyé à des usagers potentiels des informations de l'inventaire des habitats fauniques, terrestres et aquatiques en Alberta. On a relevé des variations marquées dans les besoins quant aux détails et à la teneur, selon les besoins des usagers et les problèmes visés. Presque tous les répondants (96 %) voulaient des données sur les animaux considérés comme gibier, tandis que 40 % seulement ont demandé des informations sur les autres espèces. Il apparaît évident qu'il n'existe aucune méthodologie d'inventaire des habitats qui pourrait satisfaire les besoins de la majorité des usagers. Il faut éclaircir les méthodologies d'inventaire visant à répondre à des applications particulières.

INTRODUCTION

In 1982, the CCELC Wildlife Working Group identified as a priority concern the clarification of the needs and applications of various users of fish and wildlife habitat inventory data. The Alberta Region of the Working Group attempted to gather information on this subject by distributing a questionnaire (see Appendix I) to various individuals who were likely to have some interest in, or need for, habitat inventory information for Alberta. This paper summarizes results from the questionnaire.

METHODS

Questionnaire recipients were selected subjectively to represent a diversity of working backgrounds and application areas. Eighty-eight people were contacted in the provincial and federal government, the private sector and the university/college profession. Interests and application requirements ranged from teaching and research to fish and wildlife management, environmental impact assessment and land use planning for a variety of resource management purposes.

Fifty-one questionnaire responses were received and analyzed, representing a 58% return. To help stratify and summarize the responses, all questionnaires were categorized as to the type of employment of the respondent and the primary application area being addressed by the respondent.

RESULTS

The best representation of results was from individuals with the provincial government and the private sector who had application needs in the areas of land use planning, environmental impact assessment and fish and wildlife management (Table 1). Indivi-

Table 1: Distribution of habitat inventory questionnaire respondents (& recipients) by place of employment and primary area of application (refer to affiliation and question #2-Appendix I).

	PRIMARY APPLICATION CATEGORIES				
EMPLOYER	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Total
Federal Government	2 (2)	---- (0)	1 (2)	0 (1)	3 (5)
Provincial Government	10 (13)	1 (3)	20 (35)	2 (4)	33 (55)
Private	2 (3)	10 (22)	---- (0)	---- (0)	12 (25)
University/ College	---- (0)	---- (0)	2 (2)	1 (1)	3 (3)
Totals	14 (18)	11 (25)	23 (39)	3 (6)	51 (88)

duals from the federal government and universities or colleges, plus individuals primarily interested in habitat inventory applications to research, were poorly represented.

Most respondents indicated a high level of need for habitat inventory information (Table 2). This was expected since questionnaire recipients were already prejudged to have an interest in this subject area. Over 85% of the respondents indicated that habitat inventory data was very useful or essential to their problem solving needs. The greatest need was identified within the areas of environmental impact assessment and fish and wildlife management.

	PRIMARY APPLICATION CATEGORIES				
HABITAT INVENTORY INFORM. IMPORTANCE*	Land Use Planning	Environmental Impact Assess.	Fish & Wild. Management	Fish & Wild. Research	Totals
Essential	50.0% (7)	72.7% (8)	69.6% (16)	66.7% (2)	64.7% (33)
Very Useful	28.6% (4)	18.2% (2)	21.7% (5)	---- (0)	21.6% (11)
Moderately Useful	21.4% (3)	9.1% (1)	8.7% (2)	33.3% (1)	13.7% (7)
Not Necessary	---- (0)	---- (0)	---- (0)	---- (0)	---- (0)
Totals	100.0% (14)	100.0% (11)	100.0% (23)	100.0% (3)	100.0% (51)

* Relative importance is expressed as a proportion (%) of all respondents within each application category identifying a particular importance level. Actual numbers of responses within each category is shown in parentheses and corresponds to the number of respondents.

Table 2: The relative importance of fish and wildlife habitat information to four categories of application (refers to question #1-Appendix I).*

Question numbers two and five (Appendix I) deal with desired levels of information detail. Respondents indicated needs for habitat inventory data at all map scales ranging from 1:10,000 to 1:1,000,000 (Table 3). However, overall preferences were shown for the map scale of 1:10,000 to 1:50,000 followed by 1:100,000 to 1:250,000, particularly in the fields of environmental impact assessment and fish and wildlife management. Preferences for land use planning were at map scales of 1:100,000 to 1:250,000 followed by 1:50,000 to 1:100,000. One clear implication of the responses to question number two and the results summarized in Table 3 is that many different applications are being addressed which require habitat inventory data at a great variety of map scales. No single habitat inventory product is likely to address a majority of user's needs. Irrespective of map scale detail, there was a fairly clear preference by users for maximum detail in terms of identifying the animal species or life forms and the habitat components or habitat quality provided (Table 4). Species specific designations (e.g. elk, cutthroat trout) were clearly preferred by all users over more generalized designations such as ungulates and salmonids or fish and wildlife. Detailed habitat component information (e.g. spawning habitat, nesting habitat, winter range) was also preferred over more generalized, scaled habitat capability ratings or critical/important use designations, although there was still considerable interest in the latter categories as well.

The principal fish and wildlife species or species groupings of concern to respondents were indicated in question number four. This question was so open-ended that the results were analyzed only on the basis of whether the respondent indicated an interest in game species, non-game species or both. Nearly all users in all application categories expressed a desire for information on sport and commercial game species of one type or another (Table 5). Much less interest was expressed for non-game species, with the least interest from fish and wildlife management people (26.1%), and the most interest from land use planning applications (61.5%).

	PRIMARY APPLICATION CATEGORIES				
MAP SCALE	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
1:250,000 to 1:1,000,000	12.7% (9)	7.8% (7)	14.2% (17)	20.0% (1)	11.9% (34)
1:100,000 to 1:250,000	25.4% (18)	21.1% (19)	24.2% (29)	20.0% (1)	23.4% (67)
1:50,000 to 1:100,000	23.9% (17)	15.6% (14)	21.6% (26)	---- (0)	19.9% (57)
1:10,000 to 1:50,000	16.9% (12)	33.3% (30)	30.0% (36)	20.0% (1)	27.6% (79)
1:2,500 to 1:10,000	21.1% (15)	22.2% (20)	10.0% (12)	40.0% (2)	17.1% (49)
Totals **	100.0% (71)	100.0% (90)	100.0% (120)	100.0% (5)	99.9% (286)

* Relative importance has been calculated by summing the total responses to each map scale category for each respondent within their primary interest/ application area and converting these totals to a percentage value within each of the four primary application areas.

** Total number of responses (in parentheses) exceeds the number of respondents in each category because most respondents selected more than one map scale.

Table 3: The relative importance of various levels of habitat inventory information detail (i.e. map scale) to four categories of application (refer to question #2-Appendix I).*

Table 4: The relative importance of species and habitat information detail to four categories of application (refer to question #5-Appendix I).*

	PRIMARY APPLICATION CATEGORIES				
I. SPECIES DETAIL	Land Use Planning	Environmental Impact Assess.	Fish & Wild. Management	Fish & Wild. Research	Totals
Species Specific Designations	57.1% (12)	64.7% (11)	75.9% (22)	100.0% (3)	68.6% (48)
Species Groupings Designations	33.3% (7)	23.5% (4)	20.7% (6)	---- (0)	24.3% (17)
Generalized Fish or Wildlife Designations	9.5% (2)	11.8% (2)	3.4% (1)	---- (0)	7.1% (5)
Totals**	99.9% (21)	100.0% (17)	100.0% (29)	100.0% (3)	100.0% (70)
II. LEVELS OF HABITAT DETAIL					
Habitat Component Information	50.0% (12)	47.1% (8)	43.5% (20)	100.0% (3)	47.8% (43)
Scaled Habitat Ratings	29.2% (7)	35.3% (6)	28.3% (13)	---- (0)	28.9% (26)
Critical or Important Use Designation Only	20.8% (5)	17.6% (3)	28.3% (13)	---- (0)	23.3% (29)
Totals**	100.0% (24)	100.0% (17)	100.0% (46)	100.0% (3)	100.0% (90)

* Tabular results are expressed as a proportion (%) of all responses within each use category, with the actual number of responses shown in parentheses.

** Total number of responses (in parentheses) does not necessarily equal the number of respondents if more than one choice was selected by a respondent.

The only other question that lent itself to quantitative analysis was question number six dealing with preferred types of habitat evaluation. Current habitat suitability and current habitat utilization were given only slight preference over inherent habitat capability (Table 6). Very similar three-way splits in preferences were shown within each of the four application categories. These results were not expected and may reflect poor structuring of the question. Perhaps respondents should have been forced to give a different ranking of preference for each type of evaluation as opposed to having the opportunity of indicating the same level of importance in each case. On the other hand the results may indeed reflect a genuine interest and need for all three types of habitat evaluation.

After reviewing the questionnaires received, it was felt that question numbers three, seven, and eight did not provide much useful information and no analysis of those results has been attempted for this paper. On the other hand question numbers nine and ten provided some very interesting personal comments concerning habitat inventory. These comments have been amalgamated and summarized in the following 18 points. These points have not been placed in any particular order. The number of responses which reflect a concern related to the summary points is indicated in parentheses.

Table 5: Relative importance of game and non-game species information to users of habitat inventory (refer to question #4-Appendix I).*

SPECIES GROUPS OF INTEREST	PRIMARY APPLICATION CATEGORIES Land Use Planning	Environmental Impact Assess.	Fish & Wild. Management	Fish & Wild. Research	Totals
Sport & Commercial Game Species	84.6% (11)	100.0% (11)	100.0% (23)	100.0% (3)	96.0% (48)
Non-Game Species	61.5% (8)	45.5% (5)	26.1% (6)	33.3% (1)	40.0% (20)
Total Number of Responses	(13)	(11)	(23)	(3)	(50)

* Relative importance is indicated as a percentage of responses which indicated a need for information on game species and non-game species. Actual numbers of responses for each category are indicated in parentheses.

TYPES OF HABITAT EVALUATION	PRIMARY APPLICATION CATEGORIES Land Use Planning	Environmental Impact Assess.	Fish & Wild. Management	Fish & Wild. Research	Totals
Inherent Habitat Capability	29.6% (32)	30.8% (24)	32.0% (57)	22.2% (4)	30.6% (117)
Current Habitat Suitability	36.1% (39)	34.6% (27)	33.7% (60)	44.4% (8)	35.1% (134)
Current Habitat Utilization (Population Levels)	34.3% (37)	34.6% (27)	34.3% (61)	33.3% (6)	34.3% (131)
Totals	100.0% (108)	100.0% (78)	100.0% (178)	99.9% (18)	100.0% (382)

* Relative importance has been calculated by assigning a value of 3 to a response of high, 2 to moderate, 1 to low and 0 to not useful. Tabulated results are expressed as a proportion (%) of the total weighted responses which are shown in parentheses.

Table 6: The relative importance of three types of habitat evaluation to four categories of application (refer to question #6-Appendix I).*

1. More objective methods of habitat assessment are needed to correlate biophysical and ecological characteristics of the environment with animals'needs. (1)

2. The Canada Land Inventory (ARDA) capability evaluations are usually too general, too subjective and frequently do not reflect current conditions. (20)

3. Alberta Key Wildlife Area Maps are based only on available population surveys which are not adequate in many areas. Also, the information is too general for many purposes, is often out-of-date and delineated areas lack a biophysical base. (9)

4. The term "critical habitat" is being used in such a variety of undefined ways that it is becoming virtually meaningless. (1)

5. Habitat inventory programs need to be more clearly directed towards achieving fish and wildlife management objectives, including the realization of desired future population numbers and distributions. (1)

6. A distinction should be made between the definition and classification of "inherent" and "potential" habitat. Inherent refers more correctly to the tendency of an area under more or less natural conditions to provide suitable habitat for a particular animal -- this reflects primarily biophysical and productivity factors. Potential is more encompassing and includes the relative ease with which man could alter conditions on an area of land to provide habitat -- economic factors may be of overriding concern in this context.

7. Comprehensive habitat inventory is either lacking or incomplete for most areas of Alberta. (1)

8. Under many fish and wildlife habitat management circumstances (i.e. habitat protection through various planning and referral mechanisms) short term field inspections and studies are not possible and comprehensive habitat inventory data is essential to making decisions and justifying them. (1)

9. A lack of all-season data on populations and environmental conditions may pose serious limitations to conducting an accurate and comprehensive habitat inventory. (1)

10. Careful examination of animal utilization levels is the best way of evaluating habitat inventory. (1)

11. Most day-to-day fish and wildlife management decisions require current habitat condition information whereas inherent or potential habitat information may be more useful for long term planning. (1)

12. Habitat information collected by the private sector should be used to add to and update comprehensive habitat inventories being conducted and maintained by government agencies. Such comprehensive habitat inventory data should be stored by computer, indexed by geographic area and subject matter, and made readily accessible to all sectors. (2)

13. Aquatic habitat values are not receiving sufficient attention in many areas. (1)

14. Habitat inventory guidelines are needed so that a variety of agencies (private and government) can conduct their own habitat classifications and evaluations in consistent and comparable ways. (1)

15. References and supporting data for habitat inventory in a particular area should be indicated, including which areas have been surveyed and which have not. (1)

16. Capability ratings should describe limiting factors. (1)

17. Capability evaluations should be dated and routinely updated as needed. (1)

18. More emphasis should be placed on current vegetation in biophysical land classification for the purpose of evaluating wildlife habitat. Climax vegetation is of academic interest and has little practical application. (1)

SUMMARY AND CONCLUSIONS

There is a widespread interest in fish and wildlife habitat inventory data from several sectors within Alberta. Information requirements varied substantially in scale of detail and clearly no single habitat inventory methodology could hope to meet the majority of all user needs. Substantial interest was expressed in habitat inventory data for non-game species, particularly the rare and endangered type; however, this is still overshadowed by a predominant interest in game species data. Most respondents expressed

a high level of interest in both current habitat conditions and inherent habitat capabilities.

Some respondents expressed difficulty in answering some of the questions and some found the questions to be too general. The questionnaire did however generate many interesting and useful comments. It also stimulated considerable interest concerning the activities and objectives of the Wildlife Working Group and several individuals expressed a desire for more information and contact. Future investigations such as this should pursue in greater detail the needs of very specific applications to particular problem-solving situations.

ACKNOWLEDGEMENTS

B. Markham, P. Short and D. Wooley helped to prepare the questionnaire. B. Markham and D. Rimmer provided useful comments on an early draft of this paper.

APPENDIX I

User Needs Survey for
Fish and Wildlife Habitat
Classification and Evaluation Project

The Wildlife Working Group of the Canada Committee on Ecological Land Classification (CCELC) has been formed to encourage and facilitate the development of effective and standardized methodologies for fish and wildlife habitat classification, as well as to further the integration and recognition of fish and wildlife values within an ecological land classification* framework. The purpose of this questionnaire is to determine who are the users of fish and wildlife habitat classification and evaluation products, what are their current specific needs in this area and how effectively are existing habitat classification products meeting these needs.

RESPONDENT'S NAME:

AFFILIATION AND ADDRESS:

TELEPHONE NO.:

----

* Ecological land classification may be defined as an integrated approach to land survey in which areas of land are classified and mapped as ecological units reflecting functional unity of biological, physical and climatic characteristics.

1. How important is fish and wildlife habitat information to your problem solving needs? Circle one.

   a) Essential
   b) Very useful
   c) Moderately useful
   d) Not necessary

2. Indicate your application area(s) of concern and the appropriate range in map scales best suited to your problem solving and information needs.

   Map Scale Categories

   a) 1:250,000 to 1:1,000,000
   b) 1:100,000 to 1:250,000
   c) 1:50,000 to 1:100,000
   d) 1:10,000 to 1:50,000
   e) 1:2,500 to 1:10,000

Application Areas (Circle appropriate categories)	Appropriate Map Scale (Indicate a, b, c, d, or e)*
Land Use Planning	
Policy Planning	______
Integrated Management Planning	______
Current Operational Planning	______
Natural Resource Planning	______
Agricultural Development Planning	______
Industrial Development Planning	______
Urban-Municipal Planning	______
Parks & Natural Areas Planning	______
Other ____________________	______
Environmental Impact Assessment	
Route Selection	______
Site Selection	______
Exploration	______
Development & Construction	______
Operation & Maintenance	______
Waste Disposal	______
Abandonment & Reclamation	______
Mitigation	______
Other ____________________	______
Fish and Wildlife Management	
Management Goals & Objectives	______
Species Management Planning	______
Population Surveys	______
Harvest Regulations	______
Habitat Protection	______
Habitat Development	______
Other ____________________	______

Others ______________________________

* Maximum of two scale ranges may be indicated for any one application area.

3. In which of the following ecological regions are most of your habitat information needs required? Circle the appropriate categories.

   a) Dry grassland prairie
   b) Aspen parkland
   c) Foothills of the eastern slopes
   d) Rocky Mountains
   e) Northern boreal forest

4. What are the principal fish and wildlife species or species groupings of concern to you and indicate the reasons for this priorization?

5. What levels of detail do you require from a habitat classification and evaluation? Circle those categories that are appropriate and list others that would be useful.

   Species Detail

   a) Species specific designations e.g. elk, cutthroat trout
   b) Species groupings designations e.g. ungulates, salmonids
   c) Generalized fish or wildlife designations

   Habitat Detail

   i) Habitat component information e.g. spawning habitat, nesting habitat, winter range
   ii) Scaled habitat capability ratings e.g. high, moderate, low or not capable
   iii) Critical or important use designations only.

   Additional:

6. Indicate the relative importance of the following approaches in habitat classification and evaluation. Select high, moderate, low or not useful for each category.

   a) The inherent habitat capability or potential of an area to provide essential requirements such as food, cover, space, etc. ______________

   b) The current habitat suitability of an area in providing essential requirements such as food, cover, space, etc. ______________

   c) The current population utilization levels of an area irrespective of current or inherent habitat characteristics. ______________

7. Do you have to integrate or compare fish and wildlife habitat values with other resource values and concerns? If yes, give some explanation indicating the other resource concerns involved.

8. How do you obtain the habitat information you require? Circle the appropriate categories.

   a) Generate it yourself
   b) Request other agencies to produce it
   c) Utilize only existing available products

9. If you have utilized existing and readily available habitat information indicate the source and type of product used and the strengths or deficiencies of the information content.

10. General Comments:

SUMMARY OF HABITAT INVENTORY USER NEEDS AND QUESTIONNAIRE RESULTS FOR ONTARIO

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ABSTRACT

This paper presents the summarized results of a questionnaire sent to various potential users of fish and wildlife habitat inventory information in Ontario. Identified information requirements varied substantially in scale of detail and content, depending on user needs and the problems to be addressed. Nearly all respondents wanted habitat inventory data on species of economic importance. It seems evident that no single habitat inventory methodology exists which could satisfy the needs of the majority of users. There is a need to clarify the inventory methodologies designed to meet specific applications.

RÉSUMÉ

Voici les résultats résumés d'un questionnaire envoyé à des usagers potentiels des informations de l'inventaire des habitats fauniques, terrestres et aquatiques en Ontario. On a relevé des variations marquées dans les besoins quant aux détails et à la teneur, selon les besoins des usagers et les problèmes visés. Presque tous les répondants voulaient des données sur les animaux ayant une importance économique. Il apparaît évident qu'il n'existe aucune méthodologie d'inventaire des habitats qui pourrait satisfaire les besoins de la majorité des usagers. Il faut éclaircir les méthodologies d'inventaire visant à répondre à des applications particulières.

INTRODUCTION

The Wildlife Working Group of the Canada Committee on Ecological Land Classification in 1980 identified as a priority item the need to identify "the requirements of users of wildlife and fisheries habitat classification data bases" (see Newsletter #1 of the Wildlife Working Group, January 1981). The 1982 meeting of the Working Group (March 21 to 24, 1982, Banff, Alberta) was organized to address this item. In preparation for the meeting, the Alberta region of the Working Group prepared a questionnaire, "User Needs Survey for Fish and Wildlife Habitat Classification and Evaluation Projects", which was to be distributed throughout each region to various individuals/organizations who were likely to have some interest in or need for wildlife habitat information. This paper summarizes the results for Ontario.

METHODS

* Questionnaire recipients for the Ontario region were selected from the CCELC Newsletter mailing list for the province. Names of individuals and organizations were selected to represent a diversity of interests -- various provincial ministries and federal departments (both in headquarters and district offices), consulting firms, municipal agencies, conservation authorities, universities, and fish and wildlife related associations. A total of 118 questionnaires were distributed, of which 43 were returned (roughly 36%).

The questionnaires received were broken into four groups for analysis:

1) Government of Ontario plus Ontario Hydro: 16 responses.

2) Federal government (including persons with Ontario address but with interests extending beyond the province of Ontario): 10 responses.

3) Consulting firms (several of which also indicated responses based on work outside Ontario): 9 responses.

4) Others (municipal planning departments, conservation authorities, Ontario Federation of Anglers and Hunters, Canadian Wildlife Federation, Ontario Forestry Association, and Queen's University): 8 responses.

* *The questionnaire sent out for Ontario was only a slightly modified (question 3) version of the Alberta questionnaire -- see Stelfox, Appendix I, p. 123, in these Proceedings.*

Table 1: Indicated regions of interest (refer to question 3)

	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
Deciduous Forest	7	5	5	6	23
Great Lakes - St. Lawrence Forest	8	4	7	8	27
Boreal Forest	12	9	7	3	31
Taiga	3	7	1	3	14
Tundra	-	7	1	-	8
Agricultural Lands	2	-	1	-	3

Table 2: Levels of detail required from a habitat classification and evaluation (refer to question 5)

	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
SPECIES DETAIL					
a) Species specific	13	10	8	7	38
b) Species grouping	8	4	6	3	21
c) Generalized fish or wildlife	2	1	3	4	10
HABITAT DETAIL					
i) Habitat component information	14	9	9	8	40
ii) Scaled habitat capability ratings	7	9	4	4	24
iii) Critical or important use	6	3	7	3	19

CURRENT USE OF OR ANTICIPATED NEED FOR FISH AND WILDLIFE HABITAT INFORMATION

(refer to question 1)

All respondents indicated "yes" for current use, anticipated need or both. Many as well indicated the uses made of fish and wildlife habitat information. Some of these are summarized below.

1. **Used at all stages of park planning and development processes. Used extensively in Parks Canada regional analysis studies as well as site-specific investigations.**

2. **For environmental assessments and significant area studies, the habitat requirements of the species present must be known. Much of the information is gleaned through literature searches.**

3. For park master planning and the designation of environmentally sensitive/significant areas within the jurisdiction of Conservation Authorities, habitat enhancement/user access is incorporated.

4. **Fish and wildlife habitat information is used in a general way as part of educational programs.**

5. **Used for route and site planning studies as per Ontario Environmental Assessment Act (1975).**

6. **Used for transmission line studies: evaluation of impacts of construction and maintenance, suggestions for mitigation of impacts, and recommendations for site-specific habitat management on transmission corridors.**

PRINCIPAL FISH AND WILDLIFE SPECIES OR SPECIES GROUPINGS OF CONCERN AND REASONS FOR THE PRIORIZATION

(refer to question 4)

A great variety of species and species groupings were indicated for both fish and wildlife. For fish, for example, responses included such expressions as "warm-water fish", "coldwater fish", "salmonids", family names (Salmonidae, Percidae, Esocidae, etc.), "sport fishes", "harvestable fish", "commercial fish", and individual species names. To get a general impression from all the responses, the answers were organized into a smaller number of categories.

FISH

For fish, virtually all the answers referred to species or species groupings which are harvested. Greatest emphasis was generally placed on fish caught for sport, although commercial fishing was also commonly referred to. The importance of fish resources to natives throughout the province was also referred to several times. Coldwater fishes (especially salmonids) were noted more frequently than warmwater fish.

Some of the reasons stated for priorization include:

1. Important groupings for both sport and commercial fishing.

2. Highly sought by anglers.

3. Important food species for residents of the Hudson Bay and James Bay areas.

4. In most environmental management or impact studies, the more heavily sport-utilized species are considered key indicator species.

5. Harvestable fish species, especially sport fish -- for tourism/recreation planning.

6. Salmonids (particularly brook trout) -- highly sought after game fish and indicator of high quality environment.

7. Species considered to be regionally rare, provincially uncommon or rare, or endangered within the study area.

8. Salmonids -- high profile game fish requiring high-quality, coldwater inland streams for reproduction.

9. Tied into water quality and quantity management objectives as well as recreation use designation of lands.

10. Sport fish -- general public interest.

WILDLIFE

The most commonly listed species groupings were ungulates and waterfowl, although bears, furbearers, and rare, threatened, or endangered species were also commonly named. Other responses included raptors, upland game, reptiles and amphibians, small mammals, great blue heron, songbirds, migratory birds, muskrat, hare, colonizing birds, and vascular plants.

Some of the reasons for the priorization include:

1. Wide-ranging species or species of economic importance, especially woodland caribou and moose.

2. Priorized in terms of species as habitat quality indicator.

3. Concerns for destruction of moose habitat by logging industry; cutting practices which would be beneficial to moose could also benefit a wide variety of boreal species.

4. Caribou are the third most common (major) species in the area, but are considered special because of distinct/specific locations.

5. Songbirds -- indicators of environmental change in forested areas
Ungulates -- management implications (rights-of-way and populations; effects on yarding areas)
Rare, threatened, and endangered species -- minimize or avoid impacts on habitat
Furbearers - changes in habitat, impacts on traplines, etc.

6. Waterfowl -- management of beaver ponds
Deer -- this is funded.

7. Priority based on Ministry of Natural Resources provincial and regional objectives for fish and wildlife.

8. Moose, waterfowl, ruffed and spruce grouse -- important game species. Great blue heron and osprey -- non-game species which are often disturbed by logging activities.

9. All species, in context of comprehensive land use planning.

10. Ungulates -- economic importance
Migratory birds -- international importance
Bears -- bear-man interactions.

11. Ducks, geese, moose, caribou -- important food for residents of the James-Hudson Bay communities.

12. Raptors -- endangered species.

13. All species found in any given region as Parks Canada is trying to preserve representative examples of Canada's natural history.

14. All species are of concern to Parks Canada, but emphasis placed on larger animals as they are generally more visible and of high human interest.

Table 3: Relative importance values (H - high, M - Moderate, L - Low) for three approaches to habitat classification and evaluation (refer to question 6)

Approach	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
a) Inherent Habitat Capability or Potential (of an area to provide essential requirements such as food, cover, space, etc.)					
High	6	6	5	5	22
Moderate	4	4	4	3	15
Low	4	0	0	0	4
b) Current Habitat Suitability (of an for providing essential requirements such as food, cover, spcace, etc.)					
High	12	7	7	6	32
Moderate	2	3	2	1	8
Low	1	0	0	1	2
c) Current Population Utilization Levels (of an area, irrespective of current or inherent habitat characteristics)					
High	8	5	6	4	23
Moderate	1	5	3	4	13
Low	4	0	0	0	4

Table 4: Application area(s) of concern and the appropriate range in map scales best suited to problem solving and information (refer to question 2)

Map Scales	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
a) LAND USE PLANNING					
1:250,0000 to 1:1,000,000	12	3	1	5	21
1:100,00 to 1:250,000	9	9	2	6	26
1:50,000 to 1:100,000	15	13	12	8	48
1:10,000 to 1:50,000	15	9	36	22	82
1:2,500, to 1:10,000	10	8	26	27	71
b) ENVIRONMENTAL IMPACT ASSESSMENT					
1:250,000 to 1:1,000,000	6	4	2	3	15
1:100,000 to 1:250,000	10	7	12	4	33
1:50,000 to 1:100,000	17	18	16	8	59
1:10,000 to 1:50,000	31	18	35	12	96
1:2,500 to 1:10,000	13	13	38	20	84
c) FISH AND WILDLIFE MANAGEMENT					
1:250,000 to 1:1,000,000	8	7	-	4	19
1:100,000 to 1:250,000	6	10	4	6	26
1:50,000 to 1:100,000	13	12	8	6	39
1:10,000 to 1:50,000	19	10	25	14	68
1:2,500 to 1:10,000	10	3	21	22	56

15. Migratory birds -- the principal Canadian Wildlife Service mandate.

16. Rare or endangered species -- for conservation purposes
Large animals of all groups -- for interpretation.

17. Large game (deer and moose) -- important links to recreation and economics of particular regions of study.

18. Small and large upland game -- integrated resource management and planning
Endangered species -- constraints to land use and development.

19. Endangered and rare species -- important from a habitat protection standpoint
White-tailed deer -- important from big game and aesthetic viewpoints.
Small mammals and birds -- most often associated with being near urban and agricultural areas of southern Ontario.

20. White-tailed deer -- tourism and recreation concerns.

21. Deer, ducks, geese, grouse, migratory birds, diversity of other animals -- priorization derived from the overall objectives of the Conservation Authority and species are tied

Table 5: Means of obtaining the required habitat information (refer to question 8)

Means of obtaining the information	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
Generate it oneself	13	6	9	5	33
Request other agencies to produce it	5	9	2	6	22
Utilize existing available products	9	5	4	3	21
No response	1	-	-	-	1

Table 6: Importance of fish and wildlife habitat information to problem solving needs (refer to question 10)

	Provincial + Ont. Hydro	Federal	Consultants	Others	Total
Essential	14	7	4	6	31
Very Useful	1	1	3	2	7
Moderately useful	-	2	2	-	4
No response	1	-	-	-	1

into water quality and quantity management objectives as well as recreation, forestry, and wildlife use designation of land.

22. Priority is given to "public interest" species (game, regionally rare/significant species).

23. Rare, threatened and endangered species -- to prevent the extinction of any species All species of current economic, recreational, and aesthetic value -- to restore or safeguard all populations of these species at optimum sustained yield levels.

EXISTING HABITAT INFORMATION USED

(refer to question 9)

A wide variety of information sources were indicated by the four groups of respondents. Weaknesses were outlined more often than strengths. The following summarizes the main information sources and the comments about them.

1. Ontario Land Inventory and Canada Land Inventory land capability for wildlife

   Strengths:

   - Although Canada Land Inventory maps are at too small a scale (1:250,000) for most purposes, Ontario Land Inventory maps are often useful (1:50,000 scale)

   Deficiencies:

   - Predicts what capability an area could have for wildlife productivity if a certain amount of effort was put in to upgrade the site; this is a severe limitation in determining an environmental impact for an existing wildlife habitat (i.e. it often cannot be accurately predicted)
   - Limited application in management, although some value in policy planning
   - Scale often too small
   - Too general and in some cases not accurate
   - Far too general and restricted to species which are harvested commercially or for sport
   - Too general for site-specific applications; considers game animals only

2. Photomosaics (1:15,840 scale)

   Strengths:

   - Up to date, accurate
   - Topographical information is available
   - Roads, rivers, etc. are easy to see
   - Disturbance is easy to see and map

   Deficiencies:

   - High cost
   - Must be able to interpret vegetation

3. Ontario Forest Resource Inventory Maps (1:15,840 and 1:63,360 scale)

   Strengths:

   - Good for identifying certain habitats

   Weaknesses:

   - Time consuming to use at 1:15,840 scale
   - Disturbance (logging and harvest) and not updated rapidly enough
   - Hard to read at 1:63,360 scale
   - No understory information
   - Not available on mercator grid block basis

4. Personal contacts at Ontario Ministry of Natural Resources District Offices - priority species may imbalance review (i.e. it is impossible to get information about these species)

5. Conservation authorities - data base is poor

6. Local naturalist groups - information on non-game species can be provided; it is useful but difficult to quantify

7. Pipeline and natural resource data (consultants)- strong if produced from field studies, weak if done solely from a literature search

8. Primarily aerial photographs and Forest Resource Inventory maps for Moose Habitat Management - these are adequate for the requirements

9. Northern Land Use Information Series maps (north of 60°N)

Strengths:

- Good for overview

Deficiencies:

- Habitat boundaries are very general and often conflict with local knowledge of habitats

- Not detailed enough for site-specific information

- Dated

- Based on too little ground truthing

10. Ontario Land Use Plan - does not appear to pay much attention to enhancing the quality of fish and wildlife stocks

11. Ministry of Natural Resources Land Use Studies (e.g. Lake of the Woods) - concentrates on provincial crown land

12. Specific project-related projects (e.g. Mackenzie Valley Pipeline and Polar Gas Project maps) - provide a good overview, but are dated and are generally not detailed enough for site-specific needs

13. Habitat information compiled by federal and provincial wildlife agencies (maps with explanatory text)

14. Data from natural resource ministries or conservation authorities - data are generally reliable

15. Aerial photographs

16. Discussions with personnel of provincial Ministry of Natural Resources, local sportsmen, and naturalists - usually only very general descriptions of habitat capability and basic comments on existing population levels are available for specific small sites being investigated

17. University theses

18. Provincial ministries and other agencies -- lacks sufficient detail in some cases

19. Ministry of Natural Resources, conservation authorities, and naturalist groups - existing information is incomplete and in some cases inaccurate due to collection methods (e.g. poorly supervised summer student programs)

20. Ministry of Natural Resources Regional Strategy - scale adequate for some needs but inadequate for many applications listed in Question Number 2 of the questionnaire

21. Canadian Wildlife Service, Canada Centre for Inland Waters and other federal agencies - information too general or very specific

22. Detailed site/species studies carried out by governments, universities, and specialist organizations - Problem: overload of information or specific detail; usually very little thought given to processes/problems of integration. Basic problem associated with the use of existing information is the difficulties encountered during synthesis. Methodologies, assumptions, priorities, philosophies, etc. all differ so that a reasonable integration of the information for specific purposes becomes a great challenge

23. International Biological Program - 1:250,000 scale is gross but necessary for habitat protection; details available from local agencies are sketchy

24. Environmentally Sensitive Areas (ESA) - at a scale of 1:50,000 these are too general and require site-specific refinement. Detail is good enough to highlight major concerns. Relate mainly current population utilization (with limitations)

25. Local interest groups/naturalists/ universities - general or very site-specific

26. Information from the Ministries of Natural Resources and Environment and from local naturalists - usually too general.

27. Current information from federal and provincial governments (i.e. wildlife departments) and occasionally information made available from the private sector (e.g. industry), plus reports from universities and other non-government sources - major deficiency is the paucity of information on habitat for species not commercially or recreationally utilized; also paucity for non furbearers

28. Fisheries surveys and use of the Morphedaphic Index to determine potential yields

29. Regional wildlife population densities (moose, deer, caribou)

30. Other Data Sources and Contacts

- Ministry of Industry and Tourism

- International Biological Program
- Official Plans
- Federation of Ontario Naturalists
- Regional Municipalicity of Ottawa-Carleton
- Published Reports
- Rod and Gun Clubs
- Field Inspection
- Ottawa Field Naturalist
- Federation of Naturalists
- Nature Conservancy of Canada (Toronto)
- University Biology Department
- Ducks Unlimited
- Parks Canada
- C.O.R.T.S. (Canada-Ontario-Rideau-Trent-Severn organization)

GENERAL COMMENTS (refer to question 11)

1. Land capability classification for wildlife is not adequate for environmental assessment requirements. Need a classification of habitat in terms of existing value as habitat as opposed to potential habitat.

2. The Forest Resource Inventory data base would be very useful if it was rapidly updated and available on a mercator grid format. These data should be computerized on a mercator grid format so that they can be rapidly updated.

3. There is a need for more detailed habitat analyses. There is a current preoccupation with controlling wildlife utilization (harvest), while habitat concerns are presently of secondary importance. An anticipated proactive approach to habitat management will require a sound data base.

4. For transmission line corridor planning, the impetus is for site-specific management; therefore, the smaller the scale the better.

5. Improved ability to predict and mitigate impacts on fish and wildlife would be greatly enhanced if the basic data base was vastly improved (i.e. on scale of US Fish and Wildlife Service Habitat Evaluation Procedures).

6. I do not have much faith in many of the presently used wildlife habitat rating systems for the following reasons:

   1. System may be based on a "hunch" (i.e. Hills system) rather than research papers or on empirical data.

   2. Too many ratings lumped together produce a meaningless "overall" rating (i.e. Can. Wild. Serv. rating system for southern Ontario wetlands).

   We need to know what constitutes good wildlife habitat for individual species. Lesser habitats would then be known. I feel that we do not need a rating system. It presents an invitation to competitors (developers, agriculture, forestry, etc.) to claim land use priority on average to below average ratings of wildlife habitat. Such habitat is not on an equal footing with these competing users in the first place.

   For instance, 85% of southern Ontario wetlands have already been lost to agriculture, developers, etc. Are we now to compromise the rest?

   Are we so knowledgeable that we can place a rating on a habitat and be confident about it? I think not!

   Wildlife habitat interactions are complex. Many wildlifers with advanced degrees understand their specialty rather incompletely. Simplifying complex matters is a human trait, and one that seems to be particularly desired by politicians, planners and administrators. However, the reality is complex nevertheless. And ratings are unnecessary!

7. In portions of northern Ontario, virtually all wildlife habitat management efforts are directed at moose and certain other species (osprey, great blue heron) which are vulnerable to the impact of logging. Other species are of concern; because of limitations of funds and time, efforts are concentrated on moose.

8. The greatest need now is for a wetland inventory.

9. The area/extent of the habitat for long-term preservation-representation is important. This has two aspects, either:

1. A minimum size in an ecodistrict where the exact locale is not important

    or

2. A specific locale and adjacent range.

This is a special case in park system planning requiring the use of large scale maps and having little detailed information on the resource base. Generally any detailed information that was available could not be given too much emphasis since some 99% of the area had not been surveyed at a comfortable level. Other planning exercises over smaller areas make survey feasible or workers can rely on available information.

In this case it was necessary to develop some special techniques. A method was developed to determine the minimum area of habitat having long term stability and self-regeneration (i.e. a steady state ecosystem) in order to provide habitat for all individual species. Wide ranging species that would likely be exceptions were properly documented by co-workers, thus complementing this approach and adding confidence to the validity of the final product.

10. Ecological land classification is an excellent tool in habitat evaluation, but a mechanism is needed to translate ecodistrict/ecosystem/ecosite directly into habitat capability. It should be easy, but it often takes more effort than doing the original biophysical mapping.

11. We need an approach which evaluates the sensitivity of habitat or species to development. In particular, what management practices, if any, would permit development on or near sites.

12. There is often a need for information on how/why/degree of integration/manipulation of species requirements, habitat requirements and constraints, and degree of tolerance, etc. for the introduction of diverse species.

13. Preliminary ecological investigations indicate that the ecology of the lower James Bay has been significantly changed by Hydro developments in Quebec. What effect will this have on fish populations, migrations, spawning, etc? In the absence of an economic base, the native peoples of the James-Hudson Bay Coastal Zone rely on the availability of fish and wildlife to promote both cash income and high quality protein in their diet. The consequences of the loss of these resources cannot be measured.

14. Fish and wildlife habitat information used in association with tourism operations and discussions over hunting, fishing, and trapping rights. On a district level, a "generalized" indication would be useful. On a reserve basis, however, especially for critical habitat, specific habitat information is useful.

OTHER RESOURCE VALUES WHICH ARE COMPARED WITH FISH AND WILDLIFE HABITAT VALUES (refer to question 7)

Provincial Plus Ontario Hydro

1. For route selection and highway design, also consider traditional engineering factors (safety, maintenance costs, system needs, etc.), agriculture, groundwater, noise, community disruption, etc.

2. Mining exploration, forest extraction, recreation use, park location.

3. Mainly wildlife habitat management in concert with large scale timber development and expansion. Fish habitat to a lesser degree.

4. Fish and wildlife are considered as part of a Biological Resources category for Hydro studies. Other areas of concern include Human Settlement, Agriculture, Mineral Resources, Timber Resources, Heritage Resources, Recreation Resources, Appearance of the Landscape, "Sensitive" Physical Features, and Political Fabric. Multi-disciplinary planning approach.

5. Crossing a wetland with a corridor vs. crossing agricultural land, forestry land, mineral resources, etc.

    - Need some method to compare habitat values with "economic resource" values

6. Integrate/trade-off all aspects of the environment raised as concerns by staff/Ministries/general public (30-80 usually) using a constraint map approach for location of facilities subject to the Environmental Assessment Act.

7. Timber, recreation (snowmobiles, cross country skiing, nature appreciation).

8. Forestry, provincial parks, nature reserves, pits, and quarries.

9. Relative to timber values in particular.

10. Environmental assessment impacts - trade-offs; forestry, minerals, recreation (cottages).

11. Primarily interact with forest industry concerns and particularly concerning the effect of logging operations on moose habitat.

12. Agriculture, transportation, power generation, forest and mineral extraction.

13. Timber cutting operations vs. deer habitat, etc.
    Peat extraction in marshes
    Hunting in Provincial Parks
    Land development - hydro lines, tile drainage, etc.
    Planting undesirable species in other wildlife habitat.

14. Every resource concern for which information could be obtained was involved (see below).

    These indicate the way they were evaluated for one specific park class/zone (nature reserve). Seven types were mutually exclusive and twelve were priorized in decreasing importance.

    In seeking undisturbed, no conflict areas several maps were referenced regarding the following potential conflicts:

    1. Towns, settlements, Indian Reserves, Indian settlements and proposed communities (and a 10 km radius): Population map in Ontario Ministry of Natural Resources; 1:250,000 and 1:50,000 scale topographic maps; unpublished map showing optional townsite locations for the proposed Lake St. Joseph iron ore mine;

    2. Railway lines, all season roads, telephone and hydro transmission lines: Transportation maps in Ontario Ministry of Natural Resources; 1:250,000 scale maps;

    3. Mining leases, mining licences of occupation, areas of intensive mining tenure, ore, or high grade mineral deposits, proposed mining areas: Land tenure maps in Ontario Ministry of Natural Resources; Mineral potential maps in Ontario Ministry of Natural Resources; unpublished maps on proposed Lake St. Joseph slurry pipeline route and mining area;

    4. Logging roads, logged areas, and areas committed for logging (5-year operating plans): Unpublished maps from the Ontario Ministry of Natural Resources District offices (1:250,000 scale); Landsat Imagery (1:500,000 scale);

    5. High mineral potential (class 1 and 2): Mineral potential maps of Ontario Ministry of Natural Resources;

    6. Winter roads: Transportation map in Ontario Ministry of Natural Resources; 1:250,000 and 1:50,000 scale topographic maps;

    7. Control dams, hydro dams, diversion workings: Watersheds, dams and diversions map of Ontario Ministry of Natural Resources.

    In seeking undisturbed or low conflict areas several additional maps were referenced, and listed here in order of decreasing priority:

    1. Commercial fishing lakes: Commercial fishing 1973-1978, map in Carlson;

    2. Medium mineral potential (class 3 and 4): Mineral potential map in Ontario Ministry of Natural Resources;

    3. Patent land (usually commercial lodges): Land tenure map in Ontario Ministry of Natural Resources;

    4. Leases or licences of occupation (usually commercial outpost cabins, cottages, etc.): Land tenure map in Ontario Ministry of Natural Resources;

    5. Wild rice harvest areas: Wild rice map in Ontario Ministry of Natural Resources;

    6. Proposed Polar Gas natural gas pipeline route;

    7. Land use permits (usually outpost camps, logging camps, remote cottage sites, etc.): Land tenure map of Ontario Ministry of Natural Resources;

    8. Unknown mineral potential (class 7): Mineral potential map of Ontario Ministry of Natural Resources (1979);

    9. Major portages and waterway routes: 1:250,000 and 1:50,000 topographic maps;

    10. Baselines and meridians: 1:250,000 scale topographic maps;

    11. Higher density moose populations: Moose density map (1979);

12. Ontario Ministry of Natural Resources designated canoe routes; mimeographed papers and personal communications.

Federal:

DIAND:

1. All resource values have to be considered as a function of comprehensive land use planning.

2. Generally the comparison is with non-renewable resources (mining and hydrocarbon resources).

3. For the James Bay area, what pressures on the ecosystem, habitat, and range of wildlife and fish will ensue from mineral extraction and energy-related projects.

4. For proposed land uses, considerations given to:
   - critical habitat (i.e. spawning grounds; summer-winter habitat, etc.)
   - wild rice and control of water levels for their influence on muskrat, beaver, and waterfowl.
   - forest harvest effects on wildlife.

5. In environmental impact assessments, the whole of the non-renewable resource is compared with the renewable. Also, forest protection policy considers the value of the fish and wildlife of the area or region.

Parks Canada:

6. Fish and Wildlife habitat values are considered along with such factors as geology, vegetation, landforms, and history in assessing the representivity and national significance of an area.

7. Park management relies on resource information to protect fish and wildlife populations while providing positive visitor experiences. Thus, human activities and developments are controlled to protect animal population and their habitats.

8. Physiographic features and cultural features
   - Visitors use pattern

9. Existing and proposed park facilities
   - Recreational facilities.

Canadian Wildlife Service:

10. Agriculture, forestry, mineral development, and urbanization are all important. Wildlife values have to be negotiated with these in land use decisions.

CONSULTANTS

1. Land use, socio-economic, forestry.

2. Groundwater, terrain, human interest, etc.

3. Generally have to integrate engineering aspects of a particular development scheme.

4. Forest capability and productivity, especially improvement through the manipulation of management tools and species composition.
   - Recreation activities, both consumptive and non-consumptive forms of recreational pursuits
   - Resource extraction - The comparison of "public goods" derived from the protection of rare/endangered species with the removal of sand, gravel, and other resources.

5. As most of our work concerns development proposals (subdivisions, gravel pits, landfill sites, highway and power line corridors, etc.), we normally do an environmental inventory. Based upon the species present and their habitat requirements, we decide if the development should be permitted and, if so, what alterations to the development plans are required in order to preserve the most significant features and species.

6. In some instances, the value of a marsh or trout stream may be compared to agricultural drainage needs. Protection of deer yards may be compared with requirements for recreational and rural estate development.

7. Recreation, surface water quality, forest and vegetation resources, soils and agricultural capability.

OTHERS

1. Grey County has substantial reserves of mineral aggregate resources, the development of which is quite often contradictory to preservation of wildlife and fishing resources.

2. a) Urban Development

   b) Regional versus local habitat protection. A loss of local habitat to provide habitat protection on a larger scale.

   c) Public use/access.

   d) Commercial development: golf courses, pits and quarries, industrial basins, waste treatment facilities.

3. [illegible]

4. Other resource concerns would involve: forestry, agriculture, water quality, mineral extraction, energy, industrial, exploration, urban and rural settlements, recreational and other leisure needs, etc.

5. Logging areas versus wilderness
   - Logging and wildlife - multiple use
   - Forest management for timber production versus wildlife.

A SURVEY OF THE NEEDS OF USERS OF ANIMAL HABITAT INFORMATION IN NEWFOUNDLAND/LABRADOR

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ABSTRACT

Users of animal habitat information were questioned as to the kinds of information they require on this subject. Forty percent of the questionnaires distributed were completed and returned. Responses indicated that animal habitat information was required by a variety of disciplines in a variety of situations apart from traditional wildlife management activities. The majority of respondents required habitat information on game and furbearing species as opposed to non-game species. Current as opposed to potential habitat evaluations were clearly preferred by the majority of respondents.

RÉSUMÉ

D'après un sondage des utilisateurs de renseignements sur les habitats fauniques, pour lequel le taux de réponse a été de 40%, ces renseignements sont nécessaires à une foule de disciplines, dans une large gamme de situations distinctes de l'aménagement traditionnel de la faune. Pour la majorité, ces renseignements nécessaires portent sur le gibier et les animaux à fourrure, par opposition aux espèces non chassées, et la préférence va clairement à l'évaluation des habitats actuels plutôt qu'à celle des habitats potentiels.

INTRODUCTION

The survey described in this paper was conducted to assist the CCELC Wildlife Working Group identify the needs of the various users of fish and wildlife habitat inventory information. The Wildlife Working Group identified a need for this kind of survey to help ensure that user needs were taken into account in developing guidelines for the conduct of fish and wildlife inventories in the context of ecological land classification studies.

METHODS

A questionnaire developed by the Alberta section of the CCELC Wildlife Working Group was modified for use in this survey (See Appendix I). Modifications to the questionnaire were made in consultation with interested biologists in Newfoundland/Labrador working with the federal and provincial governments and private industry.

Sixty-five (65) potential respondents were identified. These included provincial and federal personnel, private consultants, university researchers, and representatives of interested public associations. Twenty-six (26) responses representing a 40 percent return were received and analyzed. The method of analysis suggested by the Working Group chairman was followed as closely as possible to aid in the comparison of results with those from other provinces. The only variation from the suggested approach was in the manner of scoring the responses to questions stratified by application area. This arose from the fact that respondents did not identify a single application area (See question 3, Appendix I) but usually two or three. So as not to bias the responses by trying to assign a single, primary application area, the responses to each question were scored under each of the application areas identified by the respondent. This obviously increased the responses in direct proportion to the number

of application areas identified. Therefore, the data is expressed in numbers of responses rather than the total number of respondents. The key assumption made was that the responses to questions were valid for each of the application areas identified by the respondent. It was felt that accepting this assumption was preferable to attempting to assign a single, primary application area arbitrarily.

RESULTS

Figure 1 summarizes the distribution of responses relative to type of employment. The majority of respondents were provincial employees as might be expected due to their lead role in fish and wildlife management, land use planning, etc. Private industry provided the next largest group of respondents.

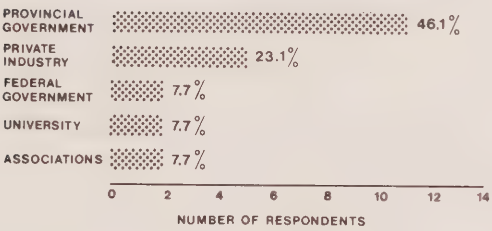

Figure 1: Distribution of respondents relative to place of employment.

Table 1 shows the distribution of interest in the various application areas relative to place of employment. It is clear that the research applications of wildlife habitat information is of limited interest. However, wildlife habitat information was considered important for each of the other three application areas.

Table 2 indicates that 75 to 85 percent of responses for the three most important application areas reflected that wildlife habitat information was essential or very useful.

The relative importance of the various mapping scales at which respondents felt habitat information should be portrayed is given in Table 3. Inspection of this table shows that in each of the three major application areas, all scales were considered important to some extent. However, the majority of interest was expressed in map scales ranging from 1:10,000 to 1:250,000 with the larger end of that range identified most frequently, i.e. 1:10,000 to 1:100,000.

The level of information that respondents required with regard to the various animal species is shown in Table 4. Information at the species and species group levels was

Table 1: Distribution of Application Interests Relative to Place of Employment

	APPLICATION AREAS				
Employer	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
Federal Government	6.2% (2)	11.8% (2)	6.2% (1)	-	7.8% (4)
Provincial Government	56.3% (9)	41.2% (7)	43.7% (7)	-	45.1% (23)
Private Industry	18.8% (3)	29.4% (5)	25.0% (4)	-	23.5% (12)
University	6.2% (1)	5.9% (1)	12.5% (2)	100.0% (2)	11.8% (6)
Associations	12.5% (2)	11.8% (2)	12.5% (2)	-	11.8% (6)
Totals	100.0% (16)	100.0% (17)	100.0% (16)	100.0% (2)	100.0% (51)

(X) - Number of Responses

Table 2: Relative Importance of Fish and Wildlife Habitat Information to the Four Application Areas

	APPLICATION AREAS				
Importance Rating	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
Essential	50.0% (8)	52.9% (9)	60.0% (9)	-	51.0% (25)
Very Useful	25.0% (4)	29.4% (5)	26.7% (4)	100.0% (1)	28.6% (14)
Moderately Useful	18.7% (3)	7.6% (3)	13.3% (2)	-	18.4% (9)
Not Necessary	6.2% (1)	-	-	-	2.0% (1)
Totals	100.0% (16)	100.0% (17)	100.0% (15)	100.0% (1)	100.0% (49)

(X) - Number of Responses

considered most important for the three major application areas. Generalized fish and wildlife designations were less favoured. A comparable pattern was evident in the relative importance of detail in wildlife habitat descriptions (Table 5). Habitat component data (e.g. nesting or spawning habitats or seasonal ranges) were considered most important for the three major application areas. Scaled habitat ratings and critical

	APPLICATION AREAS				
Map Scale Ranges	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
1:250,000 - 1:1,000,000	13.3% (4)	8.6% (3)	-	-	7.2% (&)
1:100,000 - 1:250,000	20.0% (6)	14.3% (5)	23.3% (7)	50.0% (1)	19.6% (19)
1:50,000 - 1:100,000	20.0% (6)	31.4% (11)	30.0% (9)	-	26.8% (26)
1:10,000 - 1:50,000	33.3% (10)	31.4% (11)	33.3% (10)	50.0% (1)	32.9% (32)
1:2,500 - 1:10,000	13.3% (4)	14.3% (5)	13.3% (4)	-	13.4% (13)
Totals	100.0% (16)	100.0% (17)	100.0% (15)	100.0% (1)	100.0% (49)

(X) - Number of Responses

Table 3: Relative Importance of Various Mapping Scales for Wildlife Habitat Information to the Four Application Areas

Table 4: Relative Importance of Species Detail to the Four Application Areas

Levels of Species Detail	APPLICATION AREAS: Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
Species Specific Designations	46.4% (13)	46.4% (13)	52.0% (13)	100.0% (1)	48.8% (40)
Species Grouping Designations	32.1% (9)	35.7% (10)	32.0% (8)	-	32.9% (27)
Generalized Fish and Wildlife Designations	21.4% (6)	17.8% (5)	16.0% (4)	-	18.3% (15)
Totals	100.0% (28)	100.0% (28)	100.0% (25)	100.0% (1)	100.0% (82)

(X) - Number of Responses

habitat designations, while not rejected, were considered to be less desirable.

The types of habitat evaluation information that respondents preferred are shown in Table 6. Refer to the footnote associated with this table for the method used to derive the results shown.

Responses indicated that current habitat use

Levels of Habitat Detail	APPLICATION AREAS: Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
Habitat Component Information	52.0% (13)	50.0% (15)	48.1% (13)	100.0% (1)	49.4% (41)
Scaled Habitat Ratings	20.0% (5)	30.0% (9)	29.6% (8)	-	27.7% (23)
Critical or Important Use Designations Only	28.0% (7)	20.0% (6)	22.2% (6)	-	22.9% (19)
Totals	100.0% (25)	100.0% (30)	100.0% (27)	100.0% (1)	100.0% (83)

(X) - Number of Responses

Table 5: Relative Importance of Habitat Detail to the Four Application Areas

(i.e. existing populations) and current habitat suitability were the preferred kinds of evaluation information. Inherent or potential habitat classifications (e.g. the Canada Land Inventory) were considered less useful.

Question number 5 attempted to identify the species or groups of species of most concern to the respondents. In general, the traditional furbearers and game species were of most concern to two-thirds of respondents. However, one-third of respondents clearly identified an interest in 'non-game' species as well as the traditional game and furbearing species.

Some of the survey questions (Nos. 1, 4, and 9) resulted in intermittent or inconclusive replies. This result may reflect that such questions were obscure or inappropriate. As a result, these questions have been dropped from the present analysis. The remainder of the questions (numbers 8, 10, and 11) elicited a variety of interesting opinions which are summarized below. Some of these comments are common to several respondents, others represent individual opinions.

1. "Attempts to integrate ELS or biophysical information with wildlife habitat information have been made. Difficulties encountered relate to the small scale of the ELS or biophysical maps and the attendant lack of detail. This lack of detail has also been a problem in attempting to use other kinds of habitat description or inventory information."

2. "Accurate habitat descriptions for various species are lacking. For example, habitat descriptions developed for a species in the U.S. or elsewhere in Canada do not necessarily apply to that same species in Newfoundland/Labrador."

3. "Population and community level organization information for plants and animals is important for assessing the effects of disturbance to these populations and communities. In addition, information on terrestrial and aquatic invertebrates is important for considering

Table 6: Relative Importance of three Kinds of Wildlife Habitat Evaluation to the Four Application Areas

	APPLICATION AREAS				
Kinds of Habitat Evaluation	Land Use Planning	Environmental Impact Assess.	Fish & Wildlife Management	Fish & Wildlife Research	Totals
Inherent or Potential Habitat Capability	24.4% (22)	27.2% (28)	27.9% (26)	16.7% (1)	26.4% (77)
Current Habitat Suitability	33.3% (30)	32.0% (33)	32.2% (30)	33.3% (2)	32.5% (95)
Current Habitat Use (i.e. Population levels)	42.2% (38)	40.8% (42)	39.8% (37)	50.0% (3)	41.1% (120)
Totals	100.0% (90)	100.0% (103)	100.0% (93)	100.0% (6)	100.0% (292)

Footnote: Relative importance has been calculated by assigning a value of three to a response of high, two to moderate, one to low and zero to not useful in question number 7. Results are shown as the proportion of total weighted responses which are included in parentheses.

(X) - Weighted number of responses

the food chain leading to the fish and wildlife species of concern."

4. "Information presently used includes forest inventory maps, forest capability maps and various biophysical studies completed for certain areas. The greatest deficiency (i.e. in this approach) is that there is no system to apply a species rating for each land and forestry type identified. This may be impossible for individual species but should be possible for species groups with similar habitat requirements."

5. "The use of wildlife capability rating is basically useless since most wildlife must be managed from a local point of view . . . Proper management requires detailed data specific to the study areas in question. Extrapolations and generalizations may be possible at a later point as opposed to the reverse . . . "

6. "Integration of wildlife and habitat presently requires the researcher to be a "jack-of-all-trades" since the forest or soil ecologist is not familiar with the requirements of wildlife and sometimes vice versa. Thus, integration is achieved at the researcher level."

CONCLUSIONS

The results of this survey indicated that wildlife habitat information is of significant importance to those involved in land use planning, environmental impact assessment and fish and wildlife management activities. This information should be mapped at scales less than 1:250,000 and preferably between 1:10,000 and 1:100,000. <u>Current</u> population status and <u>current</u> habitat suitability evaluations were preferred over inherent or potential habitat capability evaluations. This was accompanied by a need for habitat requirements described at the species or species group level and detailed descriptions of habitat components. As might be expected, game and furbearing species were of primary concern to most respondents. However, a clear interest in non-game species was also evident.

ACKNOWLEDGEMENTS

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APPENDIX I

User Requirements Survey
Fish and Wildlife Habitat Classification
and Evaluation Information

The Wildlife Working Group of the Canada Committee on Ecological Land Classification (CCELC) was formed to encourage the development of standardized methodologies for fish and wildlife habitat classification and further the integration and recognition of fish and wildlife information within the ecological land classification* framework.

The purpose of this questionnaire is:

- to determine who are the users of fish and wildlife habitat classification and evaluation information;

- to determine their specific needs for this information; and,

- to determine how effectively existing information and approaches to securing and evaluating it are meeting these needs.

RESPONDENT'S NAME:

AFFILIATION AND ADDRESS:

TELEPHONE NO.:

---

1. (a) Do you currently use or anticipate the need for fish and wildlife habitat information?

* Ecological land classification may be defined as an integrated approach to land surveys in which the landscape is subdivided, classified, and mapped into ecologically homogeneous units reflecting the functional unity of their biological, physical and climatic characteristics.

1. (b) If so, when, how often, and for what purpose is this information required?

   (c) What kind of habitat information do you most commonly use? (i.e. specific plant community information, generalized forest cover information, generalized land capability assessments, etc.)

2. How important is fish and wildlife habitat information to your problem solving needs? Circle one.

   (a) Essential
   (b) Very useful
   (c) Moderately useful

3. Indicate your application area(s) of concern and the appropriate range in map scales best suited to your problem solving and information needs.

   Map Scale Categories

   a) 1:250,000 to 1:1,000,000

   b) 1:100,000 to 1:250,000

   c) 1:50,000 to 1:100,000

   d) 1:10,000 to 1:50,000

   e) 1:2,500 to 1:10,000

Application Areas (Circle appropriate categories)	Appropriate Map Scale (Indicate a, b, c, d, or e)*
Land Use Planning	
Policy Planning	______
Integrated Management Planning	______
Current Operational Planning	______
Natural Resource Planning	______
Agricultural Development Planning	______
Industrial Development Planning	______
Urban-Municipal Planning	______
Parks & Natural Areas Planning	______
Coastal Zone Planning	______
Other ____________________	______
Environmental Impact Assessment	
Route Selection	______
Site Selection	______
Exploration	______
Development & Construction	______
Operation & Maintenance	______
Waste Disposal	______
Abandonment & Reclamation	______
Mitigation	______
Other ____________________	______
Fish & Wildlife Management	
Management Goals & Objectives	______
Species Management Planning	______
Population & Habitat Surveys	______
Harvest Regulations	______
Habitat Protection	______
Habitat Development	______
Other ____________________	______

* Maximum of two scale ranges may be indicated for any one application area.

4. (a) Within what geographical areas of Newfoundland/Labrador are the majority of your habitat information needs required?

   (b) What specific habitat types are of most frequent concern to you? (Please define "habitat type" from your own viewpoint).

5. What are the principal fish and wildlife species or species groupings of most concern to you and indicate the reasons for this priorization?

6. What kind of detail do you require in a habitat classification and evaluation? Check those categories that are appropriate and list others that would be useful.

   Species Detail

   a) species specific designations e.g. marten, caribou, Atlantic salmon, etc.

   b) Species grouping designations e.g. ungulates, salmonids, furbearers.

   c) Generalized fish or wildlife designations.

   Habitat Detail

   a) Habitat component information e.g. spawning habitat, nesting habitat, winter range.

b) Scaled habitat capability ratings e.g. high, moderate, low or not capable.

c) Critical or important use designations only.

7. Indicate the relative importance of the following approaches in habitat classification and evaluation. Select high, moderate, low or not useful for each category.

   a) The inherent habitat capability or potential of an area to provide essential requirements such as food, cover, space, etc.__________________

   b) The current habitat suitability of an area in providing essential requirements such as food, cover space, etc.________________________

   c) The current population utilization levels of an area irrespective of current or inherent habitat characteristics.___________________

8. Do you have to integrate or compare fish and wildlife habitat values with other resource values and concerns? If yes, give some explanation indicating the other resource concerns involved, and how this integration is achieved.

9. (a) How do you obtain the habitat information you require? Circle the appropriate categories.

   - Generate it yourself.
   - Request other agencies to produce it.
   - Utilize only existing information.
   - All of the above.

   (b) If "all of the above" was chosen, indicate the relative importance of the approaches used.

10. If you have utilized existing and readily available habitat information, please indicate the source and type of product used and the strengths or deficiencies of the information content. Please make your comments as detailed as possible.

11. Additional General Comments. (Please include information you consider important that was not focused on in the questionnaire.)

DISCUSSION GROUP SESSIONS

SESSIONS DES GROUPES DE DISCUSSION

DISCUSSION GROUP I

PROBLEM

A hydro dam flooding to the 2600 foot contour will be constructed on the Kootenay River as indicated. Hydro offers cash compensation to the Fish and Wildlife Branch related to the value of the resources lost. They stipulate that the funds be spent to enhance other habitat in the area.

DISCUSSION ITEMS

1. How well do the inventory data (as provided) enable the documentation of Fish and Wildlife losses and enhancement capabilities?

2. What types of additional information would be required to make these assessments?

3. Is the map scale of the inventory data adequate?

4. In light of the problem posed, identify the primary strengths and weaknesses of the inventory data.

5. Prepare a series of recommendations for the preparation of an ideal habitat inventory data product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content and display format.

DATA PRODUCTS EXAMINED

Canada Land Inventory (CLI) Maps for Ungulates, Waterfowl and Fisheries.

British Columbia Department of Environment Biophysical Maps.

DISCUSSION GROUP MEMBERS

Brian Fuhr (Chairman), David Rimmer (Reporter) Sean Boyd, Gaétan Guertin, David Poll, Rod Paterson, Marty Beets, Peter Boothroyd, Dennis Jaques, Helen Dudynsky.

REPORT AND RECOMMENDATIONS

Edited by David Rimmer and Brian Fuhr.

Data Product Strengths
and Deficiencies

Canada Land Inventory

- lack of general detail. Larger scale versions of these maps are needed to make assessments at less than broad regional levels. The small scale (1:250,000) would, however, be useful in obtaining a broad overview of the extent of flooding and the general nature and distribution of remaining or created habitat.
- lack of species detail. There is a need for information on a wider selection of species, especially for rare or endangered species, upland game birds, and fish. The maps limit the scope of species-specific enhancement recommendations.
- lack of habitat detail. Habitat information on these maps has been interpreted from raw data. Access to raw data is necessary for comparing habitat parcels and for negotiation purposes.
- lack of current use data. Capability ratings do not always mean species presence. These maps can show the extent of habitat loss, but not whether animals will, in fact, be lost. Conclusions about species losses are, therefore, circumstantial.
- the maps may be dated. The maps portray habitat evaluations applicable at the time evaluations were made. It is important to consider continuous interactive changes between animals and the environment in the ecological sense and in the sense of our understanding of them.
- lack of present and future land use in the valley. Present land use will limit the amount of habitat available for enhancement. For example, if farming encroaches on existing habitat, there will be no habitat available for enhancement if the new reservoir encroaches on the farms.

British Columbia Department of Environment Biophysical Maps

- legend too complex. The length and complexity of the legends demand much reading to understand the maps. The complexity provides, however, much more detail than the simpler CLI legend.
- lack of current use data. There are no indications of current use by wildlife and, therefore, species loss must be inferred from habitat loss. Fish species presence is noted, but there is no information on population status (e.g. resident, migratory), life-stage (e.g. spawning, juvenile, adult) or time of year. Enhancement options would differ greatly depending on these factors.
- lack of species detail. As for the CLI maps, there is information for only a limited number of species although whatever fish species do occur at the time of sampling are noted.
- symbolism too sophisticated. A simpler

coding system would benefit general and casual users. Nonetheless, once experienced in reading the maps, one would have little difficulty.
- have components and details lacking in CLI. The B.C. maps portray recreation, terrain, vegetation, soils and stream properties in addition to animal habitat information. This allows more reasonable assessment of enhancement capabilities although land-use data are lacking (other than recreation).

Data Product Requirements

To recommend the enhancement potential and options available after the Kootenay flooding, the detail of the B.C. Biophysical Maps combined with the broad coverage of the CLI maps would be beneficial. Following are suggestions for improvements.
- wide selection of scales and detail. Small scale maps with very general information would allow assessments of area available for enhancement. Large scale maps with much detail would allow assessment of appropriate species-specific enhancement options.
- wide species coverage. Products pertinent to all species of recreational and commercial importance should be available.
- three map coverages needed. These are: current use by all species of interest, capability of lost, remaining and created areas to support species of interest, and present (and future) human land-use.
- system of separating and combining information according to user needs. Data collection and mapping of various properties should be done in concert and should facilitate manual and/or computer editing, manipulation and overlay.
- knowledge of resource use. The value of a species (other than rare and endangered ones) is determined by how much it is in demand and/or the harvest pressure placed on the species. Therefore, there is a need for maps of harvest or demand information, perhaps in the form of dollar values. In considering enhancement of resource use, potential habitat capability may be more important than current habitat use.

PLENARY DISCUSSION

Kevin Van Tighem: You mentioned using either computer or manual overlay integration of the various data bases. What about a classification that integrates all of them? In other words, did you consider a classification that takes into account soils, vegetation and drainage features, and presents them as one?

David Rimmer: Yes, this was considered and is the result I would expect to be seeking in computer or manual overlay integration. Overlay and computer integration does not mean mere superimposition of each map, but requires a further step which is delineation of areas which have preselected ranges of each habitat property. This is classification as I believe you have suggested it. This does, however, cause loss of data detail and requires a complex legend.

Joe Kuhn: You have placed much emphasis in your evaluations on the need for assessing current wildlife usage of land units to evaluate those units. How do you rationalize that in light of the fact that it is extremely expensive to acquire those numbers, especially if considering several populations at different seasons? Additionally, populations may be low in an area at the time of a survey and not making much use of good habitat. These factors make an evaluation of land units in quantitative terms unrealistic.

David Rimmer: It is my experience that the basic question in any submission deals with what animals are really in this habitat. Habitat capability is very useful to a point, but it will be difficult to defend a land unit if it is not possible to state that there are animals there to defend. It is very important, in a practical sense, to know current habitat use.

Kevin Van Tighem: There must be a compromise. You must have some sort of count of what is there, but I do not think absolute counts are necessary.

David Rimmer: The aquatic maps of the B.C. system attempt such a compromise. The streams are described and from that, habitat capability could be evaluated. The system also tells us whether there are, indeed, any fish there; but there is no estimate of population sizes. They provide information on habitat capability and current habitat use.

Kevin Van Tighem: No matter what the actual number of animals is, it is reasonable to say, theoretically, that the most important habitat will have the highest density of animals. You need to do actual counts and then rate the habitats on what you counted rather than on an inferred productivity. In other words, you need an actual count, but it should be reduced to a rating system applicable regardless of the population density at any given time.

David Rimmer: I was just going to say that in the aquatic example. You can indicate what the capability is, but you should also indicate what is there currently. Perhaps

historical data help to clarify differences between current use and capability. Joe Kuhn made the point that high capability areas may not be used in certain years; you may need to go back several years to observe a trend.

Harry Stelfox: Planners may not approve of so many different maps with a high density of lines representing different components in the landscape. For a detailed environmental impact assessment, this separation and considerable detail is useful; but if this were a planning problem that involved different sectors and resource management concerns, it appears to be an extremely cumbersome thing to use. Perhaps my question should be directed to Brian Fuhr who is from B.C. and is familiar with this programme. Is the B.C. biophysical programme designed for planning and do you perceive problems in its application?

Brian Fuhr: The maps, as presented, are not oriented toward impact statements; but they are management oriented. Some maps are derived from the terrain and soils maps so, although there appear to be many maps, they are not generated independently. If you were dealing with an impact assessment, you may be interested in only one aspect of the assessment such as terrain, soils, vegetation, wildlife, fisheries or recreation; hence, the value of separate maps. For an overall impact assessment, I do not think they would be presented that way. I was going to comment earlier on capability and impact assessments. There are two parts to the resource assessment. First, what species are there and what are their current numbers, and secondly, the capability of the land to support the animals. Capability is more hypothetical, representing an option value which is very important as a public resource. It is the loss of the option value, as much as the loss of the animals, which is important in future management.

Christine Boyd: In light of the discussion we had and the confusion which I experienced over this, can this now be considered an ELC product? To me, it looks like a single sector biophysical treatment.

Brian Fuhr: It is an ELC product in a broad sense; the lines are similar on the soil and ungulate capability maps. It is not strictly an ELC, but the philosophy in their production is the same. The wildlife and recreation maps are derived from the soils map. Because the wildlife map is a capability map, similar soil units have the same capability, even if they have different seral stages. This is why the soils map, rather than the vegetation map, is used as the base.

Kevin Van Tighem; Is wildlife capability assessed by actually measuring wildlife parameters or is it assessed on the basis of anticipated soil productivity?

Brian Fuhr: It is based on both. You cannot consider vegetative productivity based on soil without also considering wildlife, habitat use, and the ecological characteristics of the area. The capabilities are ranked on baseline areas, areas which appear to have current use reflecting capability. For instance, a low elevation burn may exist in the area with a good seral condition (what we perceive to be a good seral state for elk) and high current use by elk. You can measure how many animals use that area and, along with historical data, use that as a baseline to extrapolate that soil to other areas with similar soil, but which have different, perhaps less productive seral condition. This would, of course, be possible only if other parameters such as climate and landform are similar for each area. However, this should not pose great difficulty because changes in the climate or landform will be reflected in the soil-type. "Ecologically oriented" soil mapping is necessary.

Christine Boyd: When assessing wildlife, were you assessing it strictly on soils or were you looking at other requirements such as escape terrain?

Brian Fuhr: You cannot assess wildlife on soils alone. You must consider each species' ecological requirements. Sheep and goats require escape terrain near foraging areas. Mule deer may prefer hummocky terrain rather than the more level terrain preferred by white-tailed deer. You must consider the position of the unit in the landscape.

Christine Boyd: Does this include the position of the units to other units?

Brian Fuhr: Yes.

Doug Meeking: You indicated that CLI maps were dated and that this was a limitation. I take issue with this because CLI is intended to present the potential to produce a particular item which will not change over ten years.

Brian Fuhr: We considered them dated in the sense that you produce a capability map at a point in time when your interpretation of the habitat of a wildlife species is based on current concepts of their ecological requirements. As you learn more about these requirements, the habitat you choose as being important may change. Some of us had CLI maps which were not useful, not because of

seral change, but because our ideas of ecology have changed. We also had some reservations on some aspects of the methods used.

Harry Stelfox: Is the set of lines for the vegetation cover different than the set of lines for soils? Is there any integration of both soils and vegetation within common map unit boundaries?

Brian Fuhr: Recent vegetation maps have lines which correspond to soil lines, but have subdivisions within those for changes in seral state. This describes a vegetation landscape, units having similar vegetative seral progression. Soils on the map in our example do change when you cross zonal boundaries and in that sense they have been integrated.

DISCUSSION GROUP II

PROBLEM

A local farmer who leases 640 acres of unimproved land for grazing purposes has just applied to provincial authorities for the right to improve the grazing potential of his lease. His proposal would involve clearing all tree and shrub cover and seeding 160 acres to tame grass. At present this leased land supports a mixedwood forest cover with a few natural meadows and shallow wetlands. Also a small trout stream meanders through the south half. The regional fish and wildlife biologist is responsible for placing restrictions and modifications on the lessee's improvement application so that only a total of 320 acres are improved and impact to the fish and wildlife resource is minimized. A major consideration for the habitat biologist will be the juxtaposition of habitat values in the surrounding areas.

DISCUSSION ITEMS

1. How well does the inventory data (as provided) enable the identification of fish and wildlife values on this lease and modifications of the application so as to minimize impact?

2. What types of additional information would be required by the regional biologist?

3. Is the map scale of the inventory data adequate?

4. In light of the problem posed identify the primary strengths and weaknesses of the inventory data.

5. Prepare a series of recommendations for the preparation of an ideal habitat product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content and display format.

DATA PRODUCTS EXAMINED

CLI Maps for Ungulates, Waterfowl and Fisheries.

Saskatchewan Terrestrial and Wetland Habitat Inventory Maps and Report.

DISCUSSION GROUP MEMBERS

Herb Goulden (Chairman), Patricia Flory (Reporter), Glen Adams, Al Bibaud, Kevin Van Tighem.

REPORT AND RECOMMENDATIONS

Edited by Patricia Flory and Herb Goulden.

Data Product Deficiencies

Canada Land Inventory (CLI)

- not enough detail given. A larger scale of map is needed. It does, however, give an indication of the wildlife population of the whole area.
- need data for more wildlife species such as upland game birds; unique, rare or endangered species; furbearers.
- there are inconsistencies in mapping with respect to capability and current land use.
- CLI tells you what you can potentially create on the land but doesn't tell you what you can afford to lose.
- lack of land use data for the parcel in question and the surrounding area.
- could not put a value on this habitat in the regional context.
- need access to the raw data - to compare the relative value of this parcel with that of the surrounding area.
- CLI is based on agricultural fertility which doesn't directly correlate with habitat potential. Example: Sandy lands are poor for agriculture but excellent for wildlife.
- CLI data does help to priorize habitat. On the basis of CLI, it is possible to determine if the habitat is small in areal extent and unique in potential or part of a large, homogeneous and possibly non-productive unit.
- CLI lacks wildlife suitability and use data for a variety of species, soils information, and land use data. This information could be contained on maps at a 1:50,000 scale which showed ELC units. Each quarter section should have overlays of land use, wildlife use, etc.

Terrestrial Wildlife Habitat Inventory (TWHI)

- some wildlife species, such as fish, were not considered in this inventory, although enough data was given on soils and topography to allow wise land use management which is reflected in fisheries management. Example: enough information is given to allow a working estimate of potential of the stream bottom for trout production.
- enough detail was given on land use, land tenure, available habitat (for a variety of terrestrial and wetland species), and wetland density to allow a biologist to put a particular parcel of land into perspective against the surrounding area; i.e. it allows the biologist to decide whether he is going to permit any clearing at all.
- not enough detail (too small a scale) to

allow decisions on placement and size of permissible clearings. This information is necessary to minimize the deleterious effects of the agricultural development and possibly even permit enhancement of the habitat.
- TWHI maps are good for public relations work. Example: farmers like to see where their piece of land fits into the general scheme of things. However, a series of 7 maps is quite daunting and may limit their use by regional biologists who do not have the time or educational background to interpret them properly.

Data Product Requirements

Ideally to deal with this problem the biologist should have a series of maps similar in scale and content to the Terrestrial Wildlife Habitat Inventory with the following modifications:
- Computerization of data to allow ease and speed of updating.
- Delete the Wetlands Density map and include its information on the land system map or have a biophysical wetland classification map which shows aridity, permanency, interspersion.
- consider more wildlife species, i.e. fish.
- instead of a Critical Wildlife Habitat map, produce a Habitat map in which every parcel of land is rated on a scale such as good, moderate and poor for the various species under consideration.
- eliminate or reduce the size of the report. Print the wildlife recommendations on the border or back of the map. Produce a less detailed summary report that covers a larger region, i.e. do not produce a report with each map.

In addition to the above product, a detailed soils map and a 1:15,000 scale map (possibly a digital landsat map) showing current vegetation and topography or ecosites must be utilized.

The type of product described would allow implementation of good land management practices including maximization of edge, retention of upland nesting cover, moderation in size of clearings, design of non-linear (angled) clearings, cutting of game trails, determination of proper location and type of clearing (seeded and/or fertilized), increased diversity, protection of sensitive habitat (such as the stream, and in particular the heronry on it), and reducing hunting impact.

PLENARY DISCUSSION

Paul Gray: In northwestern Ontario and in the northern portions of some of the provinces where extensive commercial logging operations occur, one technique used is to maximize edge through radically modifying the boundaries of the cut blocks or zones so that there is a tremendous amount of shapes and even residuals inside the zones. In a practical sense would the farmer object to weaving his way around the edges of the clearings that you have identified?

Pat Flory: Do you mean making these boundaries sinuous? This may not be too objectionable in areas seeded to domestic forage if the farmer were not planning on cutting the fields for hay, but in most cases the practicality of pulling a discer and seeder along a convoluted edge is questionable. We are trying to maximize the edge in our management plan by keeping the blocks small in size, giving them an angled shape, and by maintaining all the native openings undisturbed.

Paul Gray: Did your group talk about the size of the blocks at all? The reason being that there has been some work done on this subject and some of the results indicate that moose, for example, will move a certain distance into the openings but will not venture further unless there is some residual cover left for them. I am just wondering if that is the same case with you and consequently it would reflect in the size of the blocks.

Pat Flory: Well, actually it was not our mandate to draw up a feasible plan for this particular parcel of land. I don't know what is the best size of clearings for white-tailed deer or sharp-tailed grouse, but in this case, we are only dealing with a 640 acre parcel in which we broke up the improvements into fairly small units. I think these units are as small as a farmer would accept and yet are not so large as to inhibit the deer's use of the area. We also have a lot of edge for sharp-tailed grouse to utilize. We feel that, considering the rest of the area is forested, this type of management may even improve the habitat to some degree. There would not be a total loss of habitat potential in these areas.

Paul Gray: You could also manage the forest here. You could remove parts of climax forest.

Pat Flory: Yes.

I forgot to mention previously that even with the inventory products we envision as ideal, the biologist would still have to spend time in the field. This is not only for purposes of ground truthing but also to improve public relations.

Mark Wride: Did you consider using aerial photography in addition to the map products you have available, as you are looking at such a small area?

Pat Flory: I didn't mention it in the report but our group certainly discussed it. I personally feel that if you have a Landsat digitized map showing your vegetation and topography, it should reduce the amount of air photo interpretation needed by the regional ecologists. I personally would never be separate from aerial photos so I can't say don't use them.

Mark Wride: My comment is that I think that there are places where Landsat has good application but in an area 1 mile by 1 mile if you have an aerial photograph available, you would be able to deal much better with that farmer and show him exactly what you are dealing with in the photograph. If the photographs are available and not expensive I would say this might be a very important element in this situation, although we would like to talk about machinery and the sophisticated products.

Pat Flory: What you are actually saying is that a slightly modified Terrestrial Wildlife Habitat Inventory is our perfect product for this use; you just use aerial photos in addition for detailed vegetation analysis. In that case we wouldn't need a new map product.

Mark Wride: I am just thinking that even your 1:250,000 scale Terrestrial Series is designed for a much larger area than we are dealing with here. It is a good overview scale but I don't think I would want to deal on a 1 mile by 1 mile area with a small scale like 1:250,000.

Pat Flory: So you would not want anything on a scale of 1:250,000?

Mark Wride: Oh, I would use it as an overview but I wouldn't do my management plan without having a 1:10,000 or 1:20,000 aerial photograph if I could get it.

Pat Flory: So you would just use the Inventory as an overview and then use low-level aerial photography for your site specific work? That is what we are presently doing in Saskatchewan.

Dennis Wright: I would like to get a little more detail on your plans for the stream crossing. By just allowing cattle to go through there without adequate bottom protection, you could negate everything you are trying to protect by building a fence to control cattle access to the stream.

Pat Flory: Al Bibaud did mention that the shoreline could be riprapped where the cattle would approach the creek and that a suitable crossing could be built that would not disturb the creek. This would allow cattle access to the southern part of the section if that was desired. The farmer may object to fencing off, for example, one quarter of his land just to protect the creek and the heronry. In this manner it is possible to allow him to utilize more of his lease. Ideally though, we would not have a cattle crossing.

Herb Goulden: The experience of Al Bibaud and myself who have dealt a good deal with farmers is that biologists are not very practical when it comes to dealing with the man on the land and they are not very good salesmen. We thought the two most important things in our exercise are to be good salesmen in that we should sell the product of the terrestrial habitat map to the local biologist so he knows how to use it; number two, we are hoping that the local biologist will be a practical, down-to-earth land manager. With regard to the stream crossing, I think maybe Pat misinterpreted what we were talking about which was simply fence-controlled access to water for the cattle.

DISCUSSION GROUP III

PROBLEM

A biologist has the task of preparing a comprehensive goal-setting plan for the fish and wildlife resource of the territory. This plan will provide direction for the protection and enhancement of the fish and wildlife resources over the next 20 years. The plan must clearly identify on a territorial scale the following information:

1. The present supply of priority species and species groups.
2. The present supply of the land base upon which these animals depend.
3. The potential supply of the land bases needed to support the future animal population goals targeted by the territorial plan.

DISCUSSION ITEMS

1. How well does the inventory data (as provided) enable the documentation of the present and potential habitat (land base) and animal population supply figures required for this provincial plan?
2. What types of additional information would be required to make these assessments?
3. Is the map scale of the inventory data adequate?
4. In light of the problem posed identify the primary strengths and weaknesses of the inventory data.
5. Prepare a series of recommendations for the preparation of an ideal habitat inventory data product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content and display format.

DATA PRODUCTS EXAMINED

Land Use Information Maps, and Wildlife Habitat Inventory Maps and the Northern Ecological Land Survey Map for the northern Yukon.

DISCUSSION GROUP MEMBERS

Paul A. Gray (chairman), George Collin (reporter), Dennis G. Wright, Keith Yonge, Jack Millar, Peter Achuff, Shirley Nelson, Dennis Demarchi, Marion Porter, and Joe A. Kuhn.

REPORT AND RECOMMENDATIONS

edited by G. Collin and P.A. Gray

Data Product Deficiencies

1. Land Use Information Maps

   a) require references to assess reliability and accuracy of the data.
   b) no quantitative data is included with which to assess wildlife distribution and abundance.
   c) no identification of priority protection/management areas, or priority species for specific areas.
   d) no information on habitat utilization or availability.
   e) the large number of unique symbols resulted in difficulties with map interpretation.
   f) cultural land use information is not up-to-date.

2. Wildlife Habitat Inventory Maps for Northern Yukon

   a) the habitat areas are not related to any specific manageable land unit.
   b) subjective ratings of habitats only; there is no mention of criteria used to rate habitat.
   c) single resource based unit, which is not integrated with other forms of land use.

3. Northern Ecological Land Survey Map for Northern Yukon

   a) integration of wildlife use with ecological land units is not clearly defined.
   b) need to integrate vegetation classes used in delineating Ecological Land Classification (ELC) units with wildlife habitat units.

Working Group Discussion

The discussion focused on data requirements for long range planning for northern wildlife. Representatives from agencies responsible for managing northern wildlife (North of 60°) expressed different views about information requirements and desired map products than wildlife managers working in southern Canada. Major issues discussed included: quality of wildlife data (quantitative vs qualitative),

scale of ecological mapping (ecoregion vs ecosection), scope of wildlife species and habitat mapping (multispecies vs single species), and the role of wildlife biologists in preparing ELC maps (part of the team vs user of derived land classification units). Generally, northern managers appeared to require information of a more general nature because of the large areas of land within their respective jurisdictions. Managers from southern wildlife agencies were concerned with obtaining more detailed inventory data because of the intensive exploitation of wildlife resources in the south.

Recommendations

1. A standard approach to habitat evaluation procedures is necessary and should be consistent with the vegetation classification system used to develop ELC units. A committee should be established to complete this task.
2. For wildlife program planning in areas experiencing intensive resource exploitation, more quantitative data is required to assess habitat availability and condition.
3. Long-term cultural use of wildlife resources is necessary for effective planning of wildlife resources.
4. A computerized, geographic information storage and retrieval system should be developed, which facilitates the integration of different data sets to increase flexibility of use.

PLENARY DISCUSSION

Ed Oswald: I am the Chairman of the National Vegetation Classification Working Group and I need to know the type of information that you would like to see portrayed on vegetation classification maps. Are the vegetation types indicated for the various terrain units at the ecosite level adequate, or do you require more specific information such as density and height classes?

Harry Stelfox: Those comments are appreciated, and I think that kind of concern and interest will come up in our business meeting with respect to the activities we should be pursuing as a wildlife working group. Returning to your presentation, George, I think it is a significant point with respect to the qualitative vs quantitative components of an information base. It relates to some of the problems we have with definitions and terminology, and the use of terms such as sensitive vs critical or the best vs very good. Qualitative assessments are difficult to critically examine and repeat in an objective manner. Ultimately, management personnel want to know what these terms mean in relation to wildlife populations.

George Collin: I think you are right when discussing this in the context of southern Canada. I think a preliminary approach in long-range planning is to use the initial qualitative data as the basis for plan development. Then, as the need arises, more quantitative data can be collected and incorporated into the plan.

Joe Kuhn: My position is basically the same. When an ecological land classification inventory procedure for the Yukon is done at 1:250,000 scale, I maintain that qualitative analysis of the value of land units to individual species or species groups is the best we are going to be able to do. Harry's remarks are appropriate for impact assessments where you have a proposed development situation and you require the proponent to work at the 1:50,000 scale. Then, I think it is important to quantify the units associated with these land types. I think the difference is more a matter of scale, not geographic location, in determining whether or not a qualitative or quantitative analysis should be completed.

Kevin Van Tighem: If you are planning in a 20 year time frame, I think you must be concerned with the collection of accurate and quantitative data. You require some sort of quantitative measure (even if it is only a high/low rating system) upon which to base decisions.

Paul Gray: If you establish a rating system, then you have created a hierarchy; therefore, you must somehow define each level of that hierarchy in a quantitative manner. I think we should be working towards developing a standard approach to habitat evaluation procedures, which will assist us in developing appropriate habitat selection criteria.

DISCUSSION GROUP IV

PROBLEM

A natural resources planner is responsible for co-ordinating the development of an integrated management plan in a major drainage basin in a mixedwood forest region. The plan will be prepared by a planning team, with members representing the interests of agriculture, forestry, recreation and fish and wildlife. Planning will be conducted at a 1:100,000 map scale and will include approximately 65 townships. Primary concerns for the planning team are:

1. Extension of the agricultural land base into forest fringe crown lands.

2. An impending large scale forest harvesting agreement between the government and a private firm.

3. The protection and enhancement of significant recreational opportunities in the area, including harvestable populations of several fish and wildlife species.

4. Maintenance of priority fish and wildlife populations and essential habitats.

DISCUSSION ITEMS

1. How well does the inventory data (as provided) enable the documentation of the fish and wildlife resources (current and potential) in the planning area so as to protect and enhance these resources within the integrated management planning context?

2. What types of additional information would be required by the fish and wildlife representative to the planning team?

3. Is the map scale of the inventory data adequate?

4. In light of the problem posed, identify the primary strengths and weaknesses of the inventory data.

5. Prepare a series of recommendations for the preparation of an ideal habitat inventory data product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content and display format.

DATA PRODUCTS EXAMINED

1. Alberta Wildlife Key Area Maps and CLI Maps for Ungulates, Furbearers, Waterfowl and Fish.

2. Saskatchewan Terrestrial and Wetland Habitat Inventory Maps and Report.

DISCUSSION GROUP MEMBERS

Bob Ferguson, Geoff Holroyd, Doug Meeking, Wayne Nordstrom, Kurt Seel, David Taylor (Chairman and Reporter), Ed Telfer, Peter Van Eck, Eric Watton, Marc Wride.

REPORT AND RECOMMENDATIONS

Edited by David Taylor

Data Product Deficiencies

Canada Land Inventory (CLI) and Alberta Wildlife Maps

The maps supplied did not provide all the information required to address the problem presented. Potential habitat areas for selected species were identified which could provide an initial stratification for additional habitat or population studies. The scale at which data was presented (1:250,000) was adequate as the final plan to be developed at 1:100,000. Since the maps were part of a national series there was an opportunity to compare them to other areas where similar projects had been undertaken to assess the usefulness of the data provided.

A major problem was the lack of a common base map. Each map identified a different set of polygons which were rated for the species or theme of concern. This made data integration difficult. In addition, a variety of information judged critical for dealing with the problem posed was lacking. This includes, but is not limited to:

- information on vegetation cover detailed enough for the biologist as well as those concerned with forest capability classification,

- information on land capability for agriculture and recreation,

- information on present land use and tenure,

- information on fish and fish habitat, surficial materials, hydrology, fire history and flood risk; and finally,

- if ungulates were to be managed, a knowledge of the characteristics of snow cover in the area was considered important.

Terrestrial Wildlife Habitat Inventory

The Terrestrial Wildlife Habitat Inventory (TWHI) supplied quite good information in comparison to the previous data set. Again the 1:250,000 map scale was judged adequate for the project in question. A consistent base map at the land system level was provided and used in the development of a series of additional thematic classifications. These maps were at the same scale and supported by data in report form. This eased the chore of data integration considerably.

Only one map displayed what the group termed 'primary data'; the rest were derived or interpretive maps. It was felt that much more of the primary data should be displayed in a mapped form allowing the users to derive their own interpretations as required. Finally, it was noted that information on fish and fish habitat was entirely lacking and that primary vegetation data, although presented in the report, should have been mapped.

Data Product Requirements

The ideal habitat inventory product would be built around a standard map base in association with the 'primary data' (i.e. on vegetation, soils, surficial materials, hydrology, etc.) used to define maps' polygons. This information should be presented in such a fashion that interpretive maps can be derived from it to address, in this case, wildlife, agricultural, forestry, and recreation concerns. The following outline identifies the approach and kinds of information needed to generate this sort of product with reference to the problem presented.

It was felt that the best way to deal with this problem was to adopt the ecological land classification approach. Once a clear statement of the problem was developed and user requirements identified, the land classification team would be assembled. This team would have an independent manager (not the resource planner referred to in the problem) who may or may not be one of the specialists on the team which should include a hydrologist, a pedologist, a vegetation ecologist, a terrestrial wildlife habitat biologist, a fisheries habitat biologist, and a recreation planner. The hydrologist would need some expertise in climatology and the recreation planner would also act as a general land use planner during the project.

The end product of the survey is to be presented at 1:100,000. For this reason, it was decided that the working map scale was to be at 1:50,000. At this stage of project development decisions about the use of a computer for information processing, storage and handling would be made. Whether a computer was to be used for handling and presentation of numerical and/or spatial information has implications both for those doing the survey and those using the results of the survey.

The project team would then undertake a review of the existing information for the study area leading into the development of the methodologies, classifications, map legends and conventions, etc. to be used before pretyping of airphotos and other remote sensing imagery begins. It is at this stage that the team process becomes critical. Each member must be aware of what information he/she must supply to meet the needs of the rest of the team. Some of the kinds of information needed to develop a data base for wildlife habitat inventory and the other resource planning concerns noted in the discussion problem were identified as follows:

- descriptions of actual vegetation which include structures, physiognomy and vegetation associations,

- description of the predicted climax vegetation given the present seral stage,

- descriptions of the topography which include slope and aspect in conjunction with data on surficial materials stratified by landform,

- soils classification should follow the Canadian Soil Survey Guidelines,

- descriptions of climatological conditions would be drawn from existing sources and integrated with the hydrological studies,

- descriptions of current habitat use patterns (not population counts) for species to be managed or of special interpretive value; and

- descriptions of current and potential recreational land use as well as information on current general land use and land tenure.

No clear consensus on the kind of fisheries and fish habitat information required was reached. It was felt that the relationship between fish habitat and the other kinds of data was sufficiently obscure to warrant the handling of this aspect with a separate map overlay. Where feasible the relationships between fish habitat and the other land survey data could be discussed in an accompanying report.

Once pretyping of the ecological land unit boundaries are completed according to the criteria and methodologies agreed on, the field work phase can be done. This essentially tests the validity of the classification and pretyped boundaries. Final modifications in the classification and ecological land unit boundaries can then be made in light of the data collected.

As mentioned earlier, the primary data should be presented in association with the ecological land classification map. Each unit would be described in terms of its vegetation, soils, surficial materials, wildlife use, etc.

This information would be supplemented by a written report which would include:

- a description of the methodology,
- additional information on ecological processes of importance and other data not suitable for mapping or inclusion in legend form,
- an exhaustive bibliography.

For the purposes of the present problem it was suggested that the survey team should supply the user with several interpretative maps derived from the primary data. These maps would include maps of:

- recreational potential,
- areas requiring habitat protection or enhancement for terrestrial wildlife and fish,
- agricultural capability,
- forest cutting restraint; and
- land use allocation.

PLENARY DISCUSSION

Kevin Van Tighem: Why do you feel it is the rôle of the ecological inventory team to do the derivative maps that define what the most suitable uses are for various things? You started off by saying the ecological land classification team was to be distinct from a land manager. It seems to me those interpretations should be to some extent left to the land manager after the ELC team is finished.

David Taylor: When you do an ecological land survey you try to address the users' needs. I don't think - and this was emphasized in our discussions - we are making decisions for the land manager. We are providing him with the primary information as it has been called and a set of maps which we feel would probably be most useful to him immediately to give him a feel for how the data can be used.

Kevin Van Tighem: My concern would be that like by giving him these derived maps you are removing the onus which should be on him to understand the original maps and to make his own interpretations. If you are given a set of maps or recommendations you are spared the necessity of understanding why they are recommended and since the map is there it is easy just to use it. It seems to me that if the data is presented in such a way that the limitations and opportunities are obvious on the original maps then the interpretations will follow.

Kurt Seel: You are both right in this case but the point here is that the criteria presented to us in the questions demanded that we produce those maps; otherwise, you are absolutely correct. The ELC team should simply do the footwork, hand the whole mess over to the planner or manager and let him go do it - but in this case we have no choice. It is simply a lousy question (Laughter).

Harry Stelfox: Perhaps it was poor reading on the part of the team (Laughter). This problem scenario was drawn directly from the Integrated Management Planning Process that takes place in Alberta by the Resource Evaluation Planning Division and the Natural Resources planner that is indicated at the top of this problem is the person that is in charge of the planning team. The planning team is not an ELC team. There is quite an important distinction there. The planning team takes resource inventory information and also takes in a lot of other considerations with respect to user demands, social economic considerations and so on, and I think there is a bit of confusion about who that natural resource planner is. On each planning team there would be a fish and wildlife

representative who would be bringing fish and wildlife data to the planning team and the fish and wildlife concerns would be forestry and agriculture and so on. Maybe there was some confusion there but I won't accept full responsibility. (Laughter)

Paul Gray: I wonder if you could go into a little more detail as to how you arrived at the decision not to include population data in the planning process. The reason I am asking is that a number of land use planning programs throughout the country in the past have set target population goals and determine through range inventory or capability programs how much land or habitat they would require for that population. They then set out to either manage or protect it in some way. The way you have presented it, population dynamics are not considered. I am aware of the problems involved in population determination but even if we used relative population indices it would help us in determining the amount of land or habitat required.

Geoff Holroyd: As I see it the reason for not including population data is that it is a derivation or an application if you like, of the ELC after the ELC is completed. The interpretation of your carrying capacities as it relates to actual numbers is derived from what number of animals are there and from the habitat information that your ELC provides. Your ELC is giving the habitat background and the wildlife management user adds in population information and derives his wildlife management plan.

Joe Kuhn: The thing that strikes me again and again with the comment that the wildlife person is going to come up with information in terms of habitat usage for these land units is I don't think he is going to be able to do that in this team exercise. I think it will come with time using those land units developed by the inter-disciplinary team but I don't think you are going to be able to input habitat use information, not within a year or two which I would expect to be the time frame.

David Taylor: We are not suggesting recapture studies or anything like that. We are suggesting that we do pellet transects and apply other reasonably straightforward methods plus what is already known about the area to get an idea of habitat use.

Joe Kuhn: Let us just take pellet groups for an example. You have got a team going into a huge area all through the year starting in spring and working through the fall. Pellet groups are not going to be consistent through that period or any of your other indices of use for that matter. I just don't think you are going to do it in a year: I think people that are expecting that are dreaming.

David Taylor: Geoff, do you have any response to that from your experience?

Geoff Holroyd: Well, in terms of pellet counts, I do not want to get nailed down to specifics but you can do an awful lot of pellet counts in a summer. It depends on how many people you have got and how much they are willing to count. If you don't try to assess your wildlife population then you are sticking a wildlife biologist with an inventory that may not include any criteria applicable to wildlife in the inventory you are giving him. Joe's working in the Yukon and what I see happening there is that the biologists are not having an input into their inventory information and when it comes time to use it, if for example, there is no shrub layer information in their vegetation samples they are not going to know if that is any good for moose or not because they have done no sampling themselves and they have not had any input into the definition of those vegetation types or any of the other landform features. Initially in Banff/Jasper avalanching was ignored, an important mountain feature for wildlife but a temporary phenomenon to a botanist or a geomorphologist. Therefore, when you come to use the survey data as a wildlife biologist you are out in left field because avalanches are an important habitat modification. So you have got to have your biologist there and he has got to be sampling what he can; even if you only have got a year, you still have to try.

David Taylor: I think that if we do not have the appropriate methodologies we should get about developing some because these are the time frames that we have to work in. We cannot afford to spend five and six years getting it nailed right down because the people doing the planning, as you say, have the short time frames and there is not much you can do about it. We have got to start looking at ways of either modifying the methodologies that we have got or creating new ones and putting the level of effort in that is required.

Paul Gray: Maybe I could take just what I asked before one step further and it might clear up the reason why I asked the question. You have at the end of your list a position for an individual who assumes the rôle as recreation planner and I am assuming an

important component of recreation is hunting. You are going to have to accept certain regulations, certain quotas associated with that and consequently you cannot do that without having an understanding or at least some indication of the population dynamics of the various wildlife species in the area. I will take that one step further to the overall land use component. We are not just talking about recreational hunting but other effects of land use on wildlife populations and that is why I asked that question and that is why I cannot see a planning team ignoring that component. The other thing that I was going to ask you about is the whole concept of the planning team co-ordinator and why it shouldn't be a planner. Theoretically a planner is trained to be a generalist and capable of dealing with the various interest groups.

David Taylor: Perhaps we are being a bit provocative but the consensus based on previous experience was that the planner should not manage the ELC team because collection and synthesis of primary data might be de-emphasized in favour of data to support preconceived planning requirements.

Paul Gray: Maybe it could be a wildlife biologist who has evolved to a planning position.

David Taylor: Perhaps.

Christine Boyd: I have one comment regarding your comments on fish habitat and that is we are doing fisheries in our ELS and we have found that using the RAB system of stream inventory and drawing out reach breaks they usually coincide very closely with the terrain breaks that the geologist draws out.

David Taylor: Yes, I think we recognized that but the concern that was raised was that we could not relate that to specific fish habitat use patterns. Those breaks may be evident but there was a feeling that perhaps within those it was very difficult to relate fish habitat to other things we are mapping in the ELC. I think you are probably right. I think the relationships are there, we just haven't worked on it enough and have not asked the right questions.

Christine Boyd: The other thing is I agree with Joe, that you cannot in one year do a comprehensive wildlife survey but in some areas like the northern Yukon, why would you want to go out and do a comprehensive caribou survey, say, when they have done them for the last ten years? There has got to be a system of inputting the present state of the knowledge into the ELS and a standardized system for people who are collecting data for other reasons so it can be input into a system.

David Taylor: I have no argument with that. It would seem to me that in the collection of existing background information on the study area that kind of information would come to light and be used to establish habitat use patterns.

Christine Boyd: Do you really think it is practical before you go into the field to sit down and rationalize lines? I know from our experience that it takes us at least three months to interpret the photos for geology. Do the soils, vegetation, geology people all interpret their own air photos or do they sit down with one set of photos?

David Taylor: This is meant to be a team approach as we tried to emphasize. The wildlife biologist must participate and tell the other members of the team what information he needs to be able to identify and classify wildlife habitats.

Brian Fuhr: I would like to agree with you first that you don't have to go out and do 2,000 pellet group plots to find out that flood plains and early seral vegetation are important to moose. There is an awful lot you already know about habitat use. One of your primary concerns was the maintenance of essential habitat for wildlife. If you have not addressed the topic of capability of the land beyond what is there right now, how can you be sure that adequate land will remain to meet your management objectives?

David Taylor: I am not sure I understand you.

Brian Fuhr: If you don't address capability you don't have a good product because everything is complicated by seral change. A lot of your forest will be in late seral stage for moose and have little use but some of your best sites might be disguised by this and the areas that have a lot of moose right now might really be of lower capability than some of your better sites. A site that was recently burned which really has poor productivity might have more moose than a site that is in climax which has high productivity for moose.

David Taylor: Well, the point is as I said before, we are mapping actual vegetation and with potential or climax tacked on as a rider. That would be in the report; I doubt it would be on the map from the impression I got from our discussion. In addition, we

know a lot about what seral stages you have to go through to climax in a particular area and I think that that progression might be derived from the actual vegetation mapped.

Brian Fuhr: If I heard you correctly, I believe you wanted vegetation progression from where it is rather than looking for a full range of vegetation potential on that site because you want to know if you think this site has high potential for moose. But if it is in a late seral stage now and if you burn that site what will the vegetation look like and what will this mean to different wildlife species? You need more than just where it is going, you need where it has come from and the importance in each of those stages for wildlife.

David Taylor: So you are implying that we need to know historical data?

Brian Fuhr: Yes, or you need to infer where it is going or what the potential is.

David Taylor: You mean you can't infer that from an actual vegetation map that would tell you this particular site is fire weed and therefore, you know something about why that fire weed is there and where it is likely to go?

Brian Fuhr: You may be able to do that but if you don't have any examples of all seral stages on particular landscape type then I can't see how you could tell that from your map.

Geoff Holroyd: I have a question for you and maybe I can answer yours. If you have two sites that are identical, one was burned ten years ago and one is still in climax forest and because of the soil is in high capability are they coloured the same or indicated the same on your maps?

Brian Fuhr: Yes, I think there is confusion here between current carrying capacity and potential carrying capacity. I am talking about potential carrying capacity.

Geoff Holroyd: What I see is that your interpretation of the landscape as to capability but not allowing the kind of calculations to determine what is going on right now. In other words how many hectares of burns do you have right now, how many moose do you have, how many moose do you want to manage for and, therefore, how much more do you want to burn? If you have got your unburned and your burned of high capability both coloured the same then you can't derive that information. What we want is actual vegetation there now and as a derivation of that the text or an additional map can say that if you burn this climax forest then you are going to have a lot of good moose habitat but at least you also give the user the opportunity to see that right now it is in mature spruce and it is not burned.

Brian Fuhr: Perhaps we are saying the same thing. I don't think you can have one without the other to make an enhancement choice.

Geoff Holroyd: But you need the actual first. You shouldn't give your user the derivation and not allow him access to the actual.

Brian Fuhr: Depending on your objective, I will agree.

DISCUSSION GROUP V

PROBLEM

A major consortium of private energy companies proposes to construct a 48" diameter gas pipeline across the northern Yukon to connect with an existing line along the Mackenzie Valley. The consortium has proposed two alternate routes, although it favors route A (which is cheaper) over route B. It is required to file a detailed environmental and social impact assessment for both routes before its application for a construction permit can be approved. The area is currently in near-pristine condition and has a bountiful supply of fish and wildlife resources upon which the indigenous native population is very dependent for their subsistence economy.

DISCUSSION ITEMS

1. How well does the inventory data (as provided) enable the documentation of fish and wildlife impacts and mitigation opportunities related to the construction of route A versus route B? How well does this data also enable the further documentation of impacts to the hunting, fishing, and trapping economy of the local population?

2. What types of additional information would be required to make these assessments?

3. Is the map scale of the inventory data adequate?

4. In light of the problems posed, identify the primary strengths and weaknesses of the inventory data.

5. Prepare a series of recommendations for the preparation of an ideal habitat inventory data product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content, and display format.

DATA PRODUCTS EXAMINED

1. Northern Land Use Information Series map (1:250,000 scale) for NTS map sheet 117A.

2. Wildlife Habitat Inventory maps (beaver, moose, caribou, waterfowl, etc.) for the northern Yukon.

3. Northern Ecological Land Survey map for the northern Yukon.

DISCUSSION GROUP MEMBERS

Gary Ironside (chairman), Christine Boyd (reporter), Ed Oswald, Les Gyug, Kevin McCormick, Linda Cole, Judy Smith, Jim Hancock.

REPORT AND RECOMMENDATIONS

edited by Christine Boyd and Gary Ironside

Discussion

The group concluded that neither the Northern Land Use Information Series map for NTS map sheet 117A, the Wildlife Habitat Inventory maps, nor the Northern Ecological Land Survey map would be suitable for an environmental impact assessment of two proposed pipeline routes across the northern Yukon. The reasons for reaching this conclusion were:

1) The Northern Land Use Information Series map was far too generalized. It was basically a topographic map with some wildlife information added to it. The group was a little skeptical regarding the source and quality of the wildlife information. It is not indicated what areas of the map have not been surveyed, and therefore it is not apparent whether areas that have wildlife species indicated are devoid of wildlife or simply that no information is available.

2) The Wildlife Habitat Inventory maps were at too small a scale and the information provided was far too generalized for environmental impact assessment.

3) The Northern Ecological Land Survey map was not considered to be suitable in its present state. It presents adequate terrain information, but only very general vegetation information, some lake information, and no wildlife or fisheries information.

For an impact assessment of a mega project such as a pipeline, it was felt that a scale of 1:250,000 was adequate.

Recommendations

a) The most suitable product for an impact assessment of a mega project would be a 1:250,000 scale ELC map, with the following information:
   1) terrain and soils;
   2) present vegetation (and potential, if possible);
   3) known present and historical wildlife uses (land capability for wildlife should not be used);
   4) socioeconomic considerations such as traplines, registered big game outfitting areas, and rare and endangered species information. Rare and endangered species information should not be site specific, but rather should be indicated over a large area. A contact agency should be given for obtaining more site-specific information if it is needed.

b) The information on the map face should be in a computer-compatible matrix form. Maps and matrices should be entered into a computer system to allow for updating as the information level progresses.

c) A descriptive text should be issued with the map outlining methodologies and defining terms. This would be used as a standard in future work. Vegetation communities, soil associations, and major wildlife movements should also be described.

d) The map should have a bibliography indicating what information sources were used and where more information could be obtained (eg. as with the recently published Northern Land Use Information Series maps, which have a bibliography on the reverse side of the map).

PLENARY DISCUSSION

Paul Gray: Once the pipeline corridor has been identified, do you not think that it would be advisable to increase your scale of mapping to 1:50,000 to identify potential areas of concern in terms of eg. developing buffer zones for raptor nests?

Christine Boyd: Information at a scale of 1:250,000 is sufficient for making a selection between two proposed routes. However, after one corridor was recommended, a final alignment map would be produced based upon information of much more detail, information which is generally portrayed on map bases of considerably greater scale.

Paul Gray: I agree with the comments regarding integration and standard methodology. In the NWT, we often cannot determine the quality of studies because we do not know the survey methodology.

Joe Kuhn: Regarding your recommendations of known wildlife use and land capability for wildlife, would it not be appropriate and worthwhile to put a high capability rating on a land unit that appears to have a high capability for a species, based on known species requirements, even if the species has not been seen there in recent years?

Christine Boyd: If a species is absent from a land unit which appears to have a high capability for that species, perhaps not enough is known of the habitat requirements of the species and that unit really does not have a high capability.

Kevin Van Tighem: I think that in this example capability is being defined differently by different people. If capability is being defined as something you predict on the basis of no firm evidence, then I think that it should not be used. If, for example, no hunter, trapper, or biologist has ever seen a caribou there, although it looks like good caribou habitat, I would not want to say that it has high capability for caribou. You are going beyond what you have data to back up.

Robyn Usher: The concern that I have is whether, at a scale of 1:250,000, rare or endangered species could be effectively mapped.

Christine Boyd: Yes. A designator within a polygon could indicate that a rare or endangered species was located somewhere within the polygon. For more detailed planning, if more exact locations were needed, you could then contact eg. the Yukon or NWT wildlife branches or the Canadian Wildlife Service.

Kurt Seel: This subject is a touchy one as it concerns "privileged information". When a piece of land holds a habitat of a peregrine falcon or other species that we want to protect for specific reasons, there is often a desire to withhold that information from the public. If, at the ecological land classification level, the biologist begins hiding information, then the whole team is being deceived. If the planners are not told what is there, how can they help to protect it?

Christine Boyd: Knowing that eg. a falconry exists in the polygon, the planner can consult with the biologists to determine where it is, but this information cannot be made available to persons who may have the wrong intentions.

Kurt Seel: When dealing with large areas, it becomes extremely cumbersome for a planner or manager to phone a biologist every time to find out what the inclusion happens to be if it is not documented somewhere.

Christine Boyd: We are not concerned about the information being available to the planner or manager. We want to restrict the availability to the public.

Geoff Holroyd: In Parks Canada, rather than providing park planners with eg. eagle nest UTM's, we provide a map with circles on it. Some eagle nest UTM's are not even written down because we do not trust the computer analysis.

Kurt Seel: Nevertheless, walls are being built; I have seen too many walls, and I resent it. The other point, that of capability, has been debated over and over again. Speaking from a planner's point of view, it appears that ELC teams want to give us interpretations rather than the facts. A capability map is an interpretation.

Christine Boyd: A capability map does not have to be an interpretation. With the present state of knowledge of total habitat requirements for many species, however, I think that capability maps are interpretations.

DISCUSSION GROUP VI

PROBLEM

The coordinator for environmental affairs of a small consulting firm, retained by a large oil and gas development company, is required to locate the least environmentally damaging route for a 12 in natural gas pipeline. This pipeline will be constructed from a collection point in the exact centre of Township 46, Region 16 to the gas plant in the southeast corner of Township 46, Region 14. A 60-ft wide right-of-way will have to be cleared.

Important environmental considerations include:

1. Timing of construction to reduce fish and wildlife impacts.

2. Location of the route to avoid disturbing high quality habitat and sensitive species.

3. Enhancement of habitat where feasible.

DISCUSSION ITEMS

1. How well does the inventory data (as provided) enable the identification of fish and wildlife values and potential impacts so as to facilitate route selection?

2. What types of additional information would be required to make these assessments?

3. Is the map scale of the inventory data adequate?

4. In light of the problem posed, identify the primary strengths and weaknesses of the inventory data.

5. Prepare a series of recommendations for the preparation of an ideal habitat inventory data product which could be used to address this problem. Identify in these recommendations appropriate map scale(s), information content, and display format.

DISCUSSION GROUP MEMBERS

Mr. R. Usher
Mr. A. Krause
Mr. D. Clavet
Mr. L. Lewis
Mr. O. Nieman
Mr. B. Delaney
Mr. P. Nuttall

DATA PRODUCTS EXAMINED

Alberta Wildlife Key Area maps and CLI maps for Ungulates, Waterfowl, and Fisheries. Brazeau-Pembina ELC map and report plus Terrain Sensitivity Evaluations.

REPORT AND RECOMMENDATIONS

Edited by Mr. A. Krause

In the terms of the linear facility that we were asked to examine as a consultant to this oil and gas company, we did not feel that the initial information base (1:250 000 maps of ungulate and waterfowl capability) was at all adequate to make any recommendations on an appropriate alignment of a gas pipeline. The second information package provided focused in part on the geographical area outlined in Figure 1. The Brazeau-Pembina Study provided basic vegetation, soil, and hydrologic information for the whole area, mapped at 1:100 000 scale mapping. This is a somewhat larger scale than the 1:250 000 we had been provided with initially, but the consensus in the group was that even the 1:100 000 scale was inappropriate for making any distinctions as to the most suitable alignment, or the alignment of least environmental impact. We assumed that the proponent would provide us, the environmental consultants, with basic logistics and the engineering requirements of getting from Point A to Point B.

Although the types of information provided were suitable, there were nevertheless problems of scale. For the most part, it was felt that additional secondary sources of information, complemented with necessary field studies aimed at establishing habitat utilization of the area, were essential to the selection of a preferred route. Specifically, physiographic, soils, hydrologic, hydrogeologic, and climatologic information were considered to be essential components to an assessment of the study area's physical characteristics. Slope, aspect, and snow depth were considered especially important.

We assumed that we would be proposing, to the engineers of the oil and gas

companies, certain specific alignments and we felt that the type of information required would have to be at a scale of 1:10 000. This was felt to be necessary in order to make any distinctions on the relative impacts of the various alignments. Similarly for the biological aspects and human aspects, which we generally referred to as land use, forestry, mining, land tenure, etc. As some of the other groups have also identified in their presentations, one of the most important aspects of the data collection exercise was that the information had to be compiled at and be compatible with a 1:10 000 scale and entered into a digitized computer base that could be accessed, reorganized, and manipulated as additional concerns or constraints were identified. This would allow adjustments to the project either in terms of timing with respect to wildlife key areas or depending on what those critical areas or key areas were critical for. This was not apparent from the mapping scale or the appendices that we had for each of those maps.

On another point, as was raised by Harry just a moment ago, we debated whether it was just jargon or whether there existed a real issue as to the scale of mapping we required. We felt generally that the capability rating was not suitable for an assessment of a route alternative or preferred routes. What was needed rather, was mapping down at a suitability or utility level where some distinctions could be made in terms of extent or density of use of areas beyond those defined as critical. I do not know whether it helps or creates more problems for us in that issue but there are some transitions: we felt the issue moved from a capability level/reconnaissance data base to a more field check data base.

We propose to identify the constraints according to these elements here which would be mapped according to the physical characteristics, at 1:10 000. Once again, this is intended to be a comprehensive list but just by way of example, some of the elements are topography, surficial deposits, geomorphology, slope, aspect. In terms of habitat we would map utilization or the availability of sufficient high quality groves or any evidence of species' seasonal use of an area. Again mapped at 1:10 000. We felt, however, that the most useful approach was to have this information available in a digitized computerized base. It would then allow what we are terming elements to be ranked and reorganized in various ways, applying various criteria.

What we then are suggesting is the fourth step, in that we have separate maps for the three factors and a fourth map would be a synthesis, an integration, or an overlay through a computerized method of identifying what would be considered constraint areas or hot spots. Depending on the season of construction, the length of time required for construction, etc, these "hot spots" might vary by changing some of these other factors and we could then generate maps of the constraint areas, quite independent of the data base. We feel such a method would provide a considerable degree of latitude in examining, and variously weighting, the data. Acting as a consulting firm, the role our group assumed in this problem scenario, we felt that for our purposes our responsibility as professionals would end at detailing the constraints, at which time we would have a map of "hot spots" and in a specific route selection stage we would work in consultation with the oil and gas company in an ongoing dialogue to establish a preliminary set of "hot spots." In this manner we could identify and detail those impacts that were mitigable and those that were not.

In as much as we were asked to identify a route of least impact, we felt that it would be more suitable and more appropriate to do it in an indirect fashion, collecting the data base required to then, in a reiterative process involving the oil and gas company, establish an appropriate route.

PLENARY DISCUSSION

Kevin Van Tighem: I was not quite clear, were you saying that this was going to be mapped like polygon-type maps, mapping units, or mapping points?

Art Krause: Mapping units.

Kevin Van Tighem: Were you going to use the same polygons or the same units for the physical characteristics as for the habitat characteristics, or, were those going to be done, more or less, independently?

Olaf Nieman: Actually the polygons themselves on each individual coverage will be integrated through a model and a new coverage will be created through a computer model. The map that you are actually using or the maps you are generating will be very much different from the physical characteristics or the habitat characteristics.

Kevin Van Tighem: The reason I was wondering was that it struck me that the physical characteristics and the habitat, in a lot of cases, are probably going to overlap and I do not know how you would stratify your sampling. It seems to me that you would have to determine your habitat on the basis of something which is mappable which would be something to do with the physical characteristics. I was wondering why it would not be a shorter step to do your physical characteristics map and then rate each of your physical units for habitat value. Because I do not see how you made that step from one to the other otherwise.

Olaf Nieman: Well, presumably your habitat maps would be generated from the physical characteristics and would be entered as a separate coverage after they had been generated.

Kevin Van Tighem: So there would be common boundaries but not all the same values.

Olaf Nieman: Right.

Art Krause: I think part of the reason we were suggesting keeping them separate, as physical versus habitat boundaries, was that we were concerned with the broader implications of logistics or construction and we may have gone slightly beyond our mandate of looking at wildlife habitat concerns. There were, what we perceived to be, erosional and slope aspect concerns that might be just physical problems unrelated to the specifics of the habitat question you raised. We are trying to touch base with all the concerns. We had some difficulty trying to limit ourselves to looking at the biological habitat aspects of the construction of this kind of project. It seemed more realistic to apply this system to an array of factors, human, vegetation, physiographic, that would influence the selection of the least environmentally damaging route.

Joe Kuhn: I did not understand in your assessment of habitat units whether you were evaluating those as "hot spots" in terms of present conditions or habitat potential?

Art Krause: I guess we were aiming more towards present conditions in the presence or absence of species or presence of certain kinds of habitat where there was evidence that it was being used by various species. We were tending away from the theoretical CLI base capability rating and looking more for a ground truthed basis for identifying more site specific concerns. We felt that the site specific concerns that this project demanded required closer examination of habitat use or evidence of use.

Joe Kuhn: And a second, I think related question, is relative to your assessment of impact where that comes up in selecting route alternatives. Were you relating the value of those habitat units to the availability of the resource in terms of the larger data base (1:100 000)?

Art Krause: I think that was implied, if not stated, that the 1:100 000 scale mapping was useful as a first cut to get a general sense of what species might be of concern, what we would be looking for in the field as additional areas requiring more intensive study. In the case of the Alberta key area maps, they focused specifically on moose and elk as being in the general vicinity. That seemed to us a key identifier that we would use to look at the area proposed between Points A and B for potential use. So when we were looking for use of other areas, the 1:100 000 scale mapping would be a basis for identifying what required closer, more detailed study. For instance, there were some osprey and great blue heron nest sites identified in the general area. But because of their site specific nature, it at least gave us a basis for looking for the use of streams by the species, etc, in the general area around the nest habitat.

Joe Kuhn: What I was suggesting by my question is the need to put the impact into perspective. The regional availability of habitat "X" gives you a perspective for assessing loss of habitat "X" through development.

Art Krause: Yes that was our intention. It is not shown visually, but we had again gone through some several painstaking efforts to depict the end product, in the visual sense. We came to the conclusion that using colour symbols, or different shape symbols to identify the kind of habitat, and the kinds of potential impacts, could be interpreted in terms of short-term impacts associated with the construction of the project and the long-term impacts associated with the presence of the cleared 60-ft right-of-way. In that sense, you would qualitatively rank the concerns in order of importance and come up with some "importance value." I think that we realized that at some point establishing an "importance value" is a matter of dialogue. At some point there will be trade-offs that have to be made but we should not be in a position, or put in a position, to make the trade-offs sooner than they have to be made. Finding out what is a reasonable alignment would be done in discussion with the engineers.

Harry Stelfox: A couple of things, one perhaps is just a matter of clarification. There is no mention of vegetation up there at all really unless that is part of your land use component. And, I was just wondering whether you identified a need for vegetation mapping to facilitate the habitat evaluations at 1:10 000 scale or not? It is actually mapped and presented in 1:10 000 scale?

Art Krause: Yes.

Harry Stelfox: Okay then, that leads me to my second question: did you conceive that there is a need to integrate the vegetation mapping with the physical land mapping, and was there any attempt to determine whether an integrated type of biophysical or ecological land classification was needed or would be useful for this problem?

Art Krause: In terms of scale, I do not feel that the ecological land classification was appropriate at the units that we felt would have to be mapped in order to make appropriate distinctions. Now, I guess we sort of avoided dealing with the ecological land classification basis early on because we did not feel the scale was appropriate.

Kevin Van Tighem: I would argue with that one because my understanding is that the ecosite level of ecological land classification is in the scale of 1:10 000 to 1:50 000 and my understanding of the ecosite, at least as I have seen it used in my experience, is that it would be very appropriate for this sort of distinction that you are looking for in your map Number 1. Because you are looking at, in other words, not just a terrestrial or a landscape unit, but you are looking at how it is subdivided within itself on the basis of vegetation. At least at that scale you would be looking at that, and I think you would be getting some finer distinctions than you get if we went strictly for land form.

Art Krause: All right, I guess I will accept your suggestion.

If I might, I would like to put a question to you: were you suggesting that the ecosite data does exist for this area or as a method by which we would collect and organize the data? Is what you are suggesting mutually exclusive to what we are suggesting here or are you not just suggesting an elaboration of what we have proposed?

Kevin Van Tighem: What I was suggesting was an elaboration of what you proposed. I do not see why map Number 1 should be a map of physical characteristics. If that is your basic map that you are starting with, then you might as well look at the ELC system and throw in that aspect.

Art Krause: We were aiming at developing a mapping system that would allow "playing" with the elements, combining them in different ways and applying different weights to each. By combining them I do not mean simply internally within physical characteristics; they could be combined equally well or with equal facility with the habitat or land use factors, thus providing a system by which you would have, in effect, an ecosite map or an ecological land classification approach.

Harry Stelfox: A lot of true ELCers shudder at the thought that their art, which it is to some extent, could be replaced by some mechanical means of overlaying the variety of cuts of the landscape that could have been created in perhaps a somewhat independent way, as a substitute for the kind of mapping of landscape environments that is undertaken in the ELC type process. I just mention that as an aside. I do not really know

if we want to get into discussing that too much, but the impression that I get is that you are suggesting that in fact a computer might be an alternate or an option for creating an integrated biophysical map.

Lee Lewis: It is a tool. It is only as good as its input, most assuredly it does not lessen the need for the scientists that do creditable work. It merely facilitates and takes out the tedium and takes out the concern for memory that we may not be able to, unbiasly, integrate all these elements.

Joe Kuhn: To start with I have noticed a problem developed in our discussion group, and apparently this one, between segregation of biophysical landscape assessment and land use value assessment. What I recall happening in British Columbia was one good example. When the guidelines were developed by the environment land use committee, the biophysical work had to pretty well stand on its own as an ecological science, interpretive, and interdisciplinary product. In other words, in this case, I think we have to combine the mapping into ecosite units. Our scientists agree upon those units and then we go into the socioeconomic realm where people start placing values and using wildlife as an example. Paul Gray gave a very good example of something that they run into in the NWT all the time. The wildlife biologists and management biologists may evaluate certain terrain units differently as to their wildlife value than the natives who are subsisting or cropping those resources because of proximity, access considerations, cultural traditions and so forth. So I think that it is pretty important not to mix up the socioeconomic land use matters with biophysical. I think that they have got to be integrated but when we are doing the biophysical assessment, do that as one level of operation and then bring in the social science people in the community and develop the socioeconomic overlay on the biophysical base.

Doug Meeking: I would just like to make a couple of comments on the overall process. I think that you have used the right process for the job at hand and the size of the project. But, one thing and I guess it follows from Harry's last comment on the issue of the computer. I think that you could generate the synthetic map of "hot spots" with a simple series of overlays, transparent overlays on your basic base map that would do the same job as your computer would; and for a project that involves a 26-mile pipeline, the computerized mapping would, in my opinion anyway, be overkill.

When you get into a much more complex situation than you have here in the eastern slopes of the foothills, maybe Southern Ontario where you have got any number of complex situations, land use planning restrictions, or Lord knows what other types of restrictions to deal with, then I would argue that a computer would be able to handle masses of data much better than a small number of humans will. But in a very straightforward situation like you have here I would argue that the manually generated use of transparent overlays would do the job entirely adequately. That is just my own point of view. One other thing on the use of the 1:10 000 scale in your route selection process, were you looking at trying to obtain a final alignment or a corridor of a 1/2 km in width or 100 m?

Art Krause: We were given the task of determining a 60-ft route and we presumed we were looking for a 60-ft route: the subsequent stage to this would be a centre lining procedure which would obviously be done in more detail.

Doug Meeking: Typically in a pipeline situation like that, you would have a 60-ft wide corridor, clear cut I think, and provide some working area 30 ft either side of the centre line. In real life, the engineers will make the final alignment. They will draw the lines for the centre line, no doubt about it. Again, I think the 1:10 000 scale would allow you to very accurately define a corridor of say 100 m within which the engineering people could define their 60-ft swath that they are going to want to clear cut. But overall I think you handled the process very well.

WORKSHOP SUMMARY

E. Telfer
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Harry asked me to review and summarize the Workshop. We have just heard the presentations and we are also going to get proceedings so it would be boring in the extreme if I give a minute account of everything that I think I have heard here. My account probably would not be too accurate anyway because, as Harry pointed out, Ecological Land Classification is something of a peripheral subject to me although I have had connections with land inventory work for a long time. I remember, about 1965, sitting down in a workshop with wildlife biologists from Quebec and the Atlantic Provinces to discuss how we were going to categorize moose habitat in the Canada Land Inventory. That followed a lot of experience I had in timber inventory work as a forester, and was the sort of subject that I could relate to. I have, therefore, maintained an interest in ELC over the years. This interest was abetted by my friendship with Will Holland which goes back to those days.

I think that the best approach that I can take here is to pick certain aspects that I have heard or that appear to me to be important and that have been covered by various people here in various ways and to dwell on those a bit. I do not have any solutions to some of these things but perhaps I can help focus some of the problems and considerations and also help us to put ELC in a tighter perspective within a framework of our whole operation in the field of wildlife management. Wildlife management, of course, is a subset of natural resource management in general.

Dave Neave made the comment that "habitat is the key". This is a pet slogan of all of us in wildlife biology and I think that basically it is true. However, I think that we have to be a bit careful not to exclude or to overlook other factors that are important also. This idea of habitat as being the critical fundamental thing in the maintenance and the improvement of wildlife populations has, I think, been with scientific wildlife management from the start, almost half a century ago. It stems from the original work of Aldo Leopold who was in fact a forester and was always conscious of this land and vegetation background - the stage on which the interplay of increasing and decreasing wildlife populations took place. Aldo Leopold got a lot of his field experience in places like New Mexico and Wisconsin where the extremes of climate are considerably less than we face in Canada. My concern here is that as we get toward the extremes of climate it perhaps becomes increasingly important. Certainly we know that if an animal species is going to survive it has to have a habitat. If, by some process, we progressively removed airports, at some point we would not have many jet planes in the air any more! However, when climate can be as adverse as it is in the north or even here in southern Alberta what kind of importance should we give to habitat? At what level is the loss of habitat going to limit wildlife production? I think that we have to query the usefulness and the potential of habitat improvement in these types of environments as compared to the value of other management activities. We should concentrate to some extent on this fundamental concept of our whole operation. Let's work out more carefully in our own minds and hopefully in research, just how important habitat is anyway.

Another thing that struck me as I talked to people here and as I looked at the poster sessions the other day, is that we really are not sure what ecological land classification is. There seems to be a variety of opinions and this is good. Some of my concern is purely my own ignorance but it also relates to the fact that we are dealing with a very complex subject here. There will be a great variety of opinion and a great variety of approaches. Great. That means that we can progress! But, I think that there is a certain amount of confusion as to just what we are up to when we are involved in ELC. This

goes back to some basic confusion regarding what is inventory activity and what is scientific activity, and how inventory relates to progress in science and in management. I think that this is sufficiently important and worthwhile to push it a bit further.

Suppose we are faced with a situation that is unknown. We want to move by a process of discovery from the unknown to a situation that I have called here "more or less known" (Figure 1). As we go along this process of discovery there are a number of steps along the way. At first we are in a state of confusion about the situation so we inventory it to find out what we have. The next step is analysis of the results of our inventory. Then we are in a position to find out even more by refining our approach. We can focus in on the problem through experiment, which of course is the classic approach in science. If we break down these functions a bit, the first step in an inventory is to design it. Then we have to get out and collect the information, then summarize it. The product can be a written report or can be tabulated data or maps. Then we analyse the situation, basically using correlation, a very popular technique in science, and various other statistical approaches. We try to relate the features that we have inventoried to see if we can gain an understanding of what causes them to vary.

Having done that we are in a situation to make a hypothesis about the way some of these things are related. The hypothesis as a rule takes a form of a prediction. We can test the prediction either in fortuitous research opportunities or by experimental situations that we create. Through our tests we will end up with a capacity to predict the results of our actions. That is the way science works and it is my contention that management works that way as well. When we plan the use of a land area we have a number of alternatives as to how to collect information on different parameters. We have the usual thematic approach including soil maps, forest inventories, plant communities, animal numbers, etc. I was interested in the last workshop group discussion where there were comments on the thematic approach. You can derive through analysis a series of maps or some other kind of product but basically in land inventory we deal with maps. So we end up with a derived map. Now if we go out, as has been done here in Banff and Jasper, and make an inventory by the ELC method we essentially combine those steps and we end up in the end with a sort of correlation; everything is on the map to begin with and we have a complex legend. We are essentially hypothesizing that animals are going to be on certain land forms; certain map polygons will have different levels of animal numbers for instance.

I would like to point out that a management plan or prescription is just like any other scientific hypothesis and it can be tested when you go out and implement a plan of habitat improvement, habitat protection, etc. You then monitor the results of your plan. Monitoring is the key thing. Unfortunately, a lot of managers do not really want to know that their hypotheses turned out to be wrong. That might be embarrassing! If you monitor implementation of your prescriptions you are going to find that you then can refine your management procedure just as a scientist refines his hypotheses, just as a chemist may do in the laboratory, continually feeding back on his hypothesis about what element he has, etc. Now that, I think, is a process that is just as respectable intellectually as any process of scientific discovery and I think managers do it every day!

I pointed out how inventories fit into that process (Figure 1). Perhaps just as a matter of interest it would be fun to look at how some of the other kinds of work we consider properly scientific might fit. For instance, perhaps the average paper in a popular natural history magazine would fall into the inventory class. Somebody went out and they found a nest of some bird not previously reported in their area and they wrote it up as a bit of inventory data. If you look into any journal of science like the Journal of Wildlife Management much of the material consists of papers that include inventory and analysis of several parameters (Figure 1). About like an ELC document. Some of them will go a bit further and make a hypothesis. That step is more respectable science. The comparable level in management is production of a management plan. Now, of course, the best and most complete scientific work starts with an inventory and goes straight through the whole piece including hypothesis, testing, monitoring the tests, feedback to rework the hypothesis, etc. It is also quite possible to start with someone else's hypothesis.

I think that we should be quite clear that what we are doing when we conduct inventories and create hypotheses in the form of management plans is to look at the process of wildlife management as a whole and see where ELC fits. In Figure 2, I have sketched the wildlife management decision-making process. Somebody, either a planning team or an administrator has to make the decisions. If a plan-

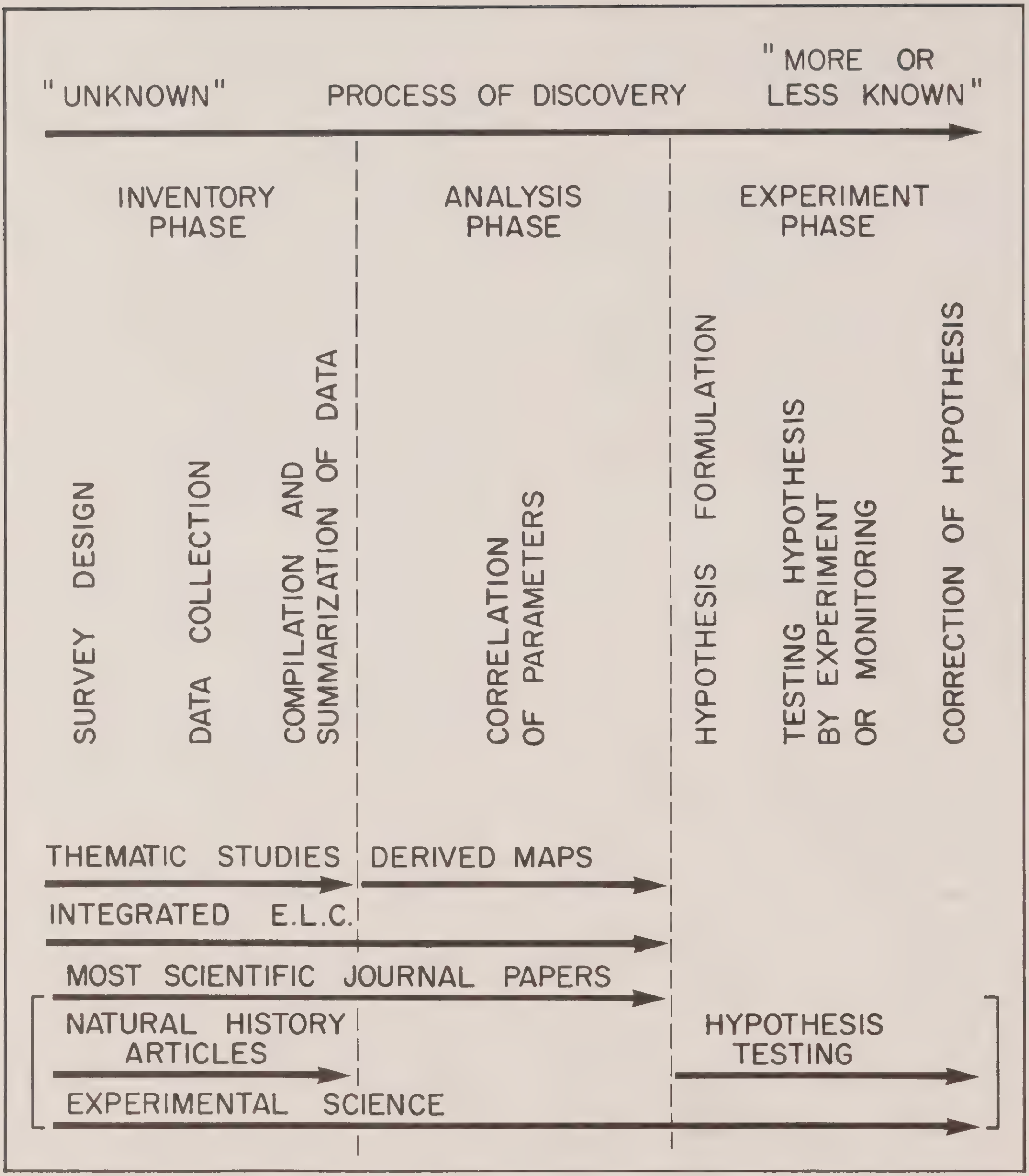

Figure 1. Schematic diagram illustrating the process of rational investigation of problem areas of natural science showing suggested relationships of inventory and experimental studies.

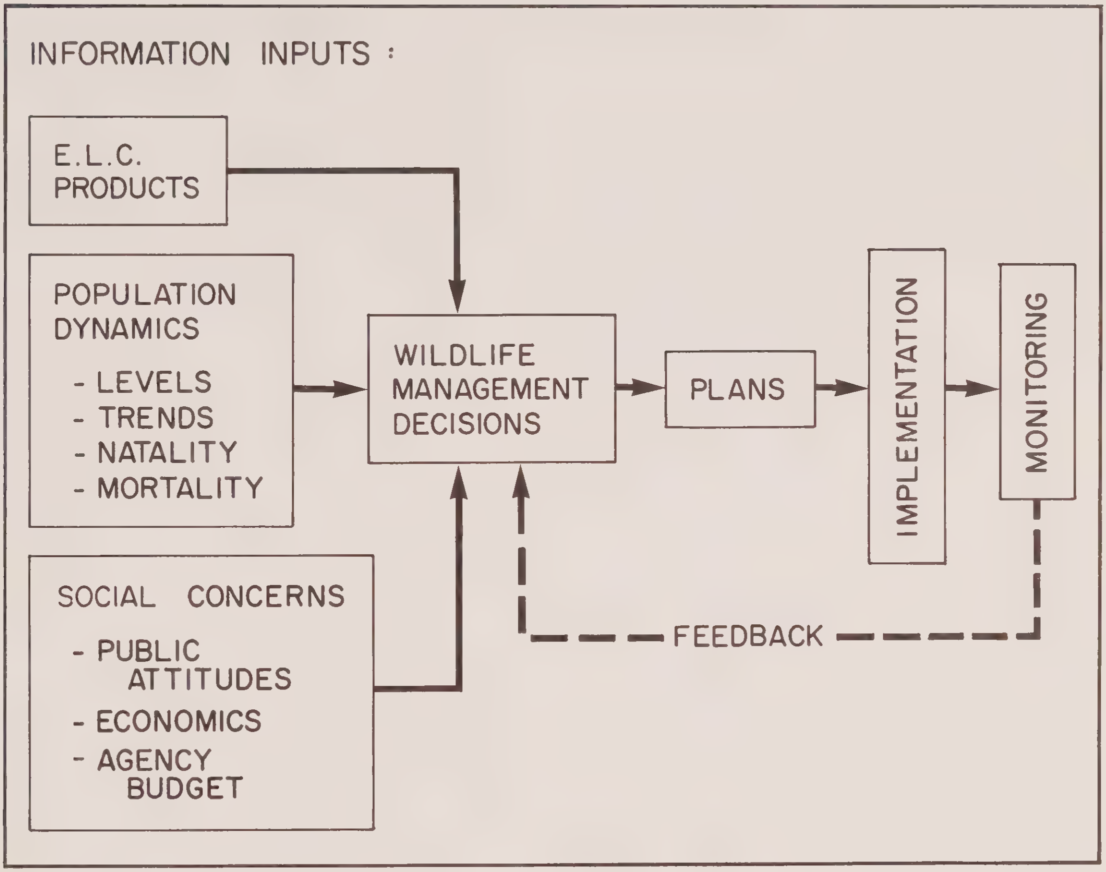

Figure 2. Schematic diagram illustrating the process of wildlife management decision-making.

ning team makes them then an administrator usually gives them his blessing. One of the things that is going to be taken into consideration here are the products of the ELC. You have to know what you have to deal with before you can make a decision on how to handle it. However, there are a lot of other considerations beside ELC data. If it is a wildlife decision you are going to have to look at the species population dynamics. What level are the animals at now? What were they at last year? Five years ago? What is the trend? Is it up or is it down? What are the natality factors? How many animals are being added to the population every year? What about mortality? How many are being shot? How many are being eaten by wolves, say, or perhaps dying from pollutants in the case of fish? These are all natural history-type inputs but social concerns are going to be important too as we heard in the last workshop group's comments. Is the public concerned about the level of numbers of the species under consideration or don't they give a damn? Is the species important to the scientists, but not to the hunters or vice versa? What are the economics of the situation? Are you going to have to bring local economic development to a screeching halt in order to protect certain species? Then, of course, there is the problem of agency budget. Obviously you cannot embark on a major program to restore habitat or purchase habitat, for instance, if you do not have an adequate budget. That all has to be considered when the management decision is made.

Once a decision is made it is essentially a hypothesis as we saw in Figure 1. The decision may be that, if we can preserve, for instance, the riparian habitat that will be all we need to keep a particular bird species happy. The plan is made and hopefully is implemented and the right area and habitat are reserved. Ideally there would be a monitoring program to see if the plan achieved its intended goal. Maybe five years later we find that we have only 10 percent as many of species A as we had when we started trying to save it. That sort of thing is not unheard of! However, maybe the management prescription has worked and the population trends and numbers continue as they were. The manager either changes his plan or decides that he is on the right track. There may also be a pretty sharp feedback from the public who say things like: "Wait, you have got to do more to protect the deer habitat than you have been doing". Maybe it will be found that the ELC products did not include a couple of key parameters and one must go back to the field and get more information. I think that we have to realize that in this process the key thing to note is that ELC products are important but are only one input to management decisions. The point was made quite forcefully by both Dave Neave and Ron Jakimchuk that there are a lot of other things that have to be considered also.

Another thing which concerns me and the personnel involved with the Banff/Jasper inventory is how we are going to "sell" our ELC product. Kurt Seel dwelt on this the other day. We can easily fill libraries with document reports which no one bothers to read before they make decisions. The same thing can happen with an ELC product too. Perhaps the problems are at least as great if we are talking about computerized data banks, products that require a certain amount of technological sophistication to get at them. How many people that might use data banks are going to have that sophistication? How are we going to ensure that they do have it, that they realize that what we are producing is important? Kurt came up with the key word that for a product to sell it must be "user friendly". It is said that if you use a term a few times from then on it is yours so I will be throwing out "user friendly" every so often!

There is a barrier between ELC products and reports at the completion stage and the implementation of them. When a management agency has funded a major study the product comes in and there it is. The consultant or a staff member who did the job is through with it. He has compiled the results. He has perhaps analysed it and may have done a good job but a barrier still exists. Somehow the ELC results do not get into use. If we go back to Figure 1 the barrier quite often is between the analysis stage and the stage of hypothesis construction and prediction. We conduct an inventory and an analysis and give the results to the manager. He either does not have the knowledge to assess the material and therefore makes a poor hypothesis about how it applies to management or perhaps he is just too darn busy. He would like to do a proper job but he just does not have time so he just skims through the report and proposes something which may not have any relation to the material that he has actually been given in the ELC product. I think that there are also other reasons why this barrier problem exists. There may have been lack of communication about what was the original "unknown". Maybe the design of the inventory was faulty and the parameters studied were not relevant. The result was a bunch of material that was either completely astray or only partly focused on the problem.

To return to another problem that I think that we really have to be concerned about in the Banff/Jasper Biophysical Survey is that results of inventory and analysis may be inaccessible because we stored them in a computer system. Are the people who really need to use the information able to use the computer? Fortunately this will become less of a problem in the future as we now see computing being taught even in high school. However, at this time there is still a problem which will exist for a number of years. In fact, computer use will probably always cause some lack of communication but eventually it will become no more serious than Kurt's shelf full of reports that have to be read but aren't because busy managers don't like to wade through three-hundred-page, two-volume reports.

To summarize all these comments about selling the product, we have to remember that ELC is a complex phenomenon. It is hard to popularize. Did you ever try to explain to somebody with no knowledge of natural resources at all what the devil we are trying to do? One of my friends who is quite knowledgeable on land inventory decided to write an article for a popular natural history journal explaining the ELC process. He wrote a short draft and the thing went over like a lead balloon with the editor. I think this is indicative of how hard it is to take this complex process with all these parameters and assorted maps and explain it to the public. If you want to speed things

up the line to managers and administrators you cannot make it too simple. Selling is a problem and we must concentrate on it at all stages.

There is one final point that I would like to make in relation to something Ron Jakimchuk said and that is the importance of research into relationships between habitat features. Why is it that animals use certain features? What predictive capability do we have? I think that after fifty years of research on white-tailed deer and moose and elk we have not yet achieved 100 percent capacity to predict where they will be, why they will be there and when they will be there. When it comes to the whole array of non-game birds and other wildlife we really have limited knowledge of why they are where they are and in fact limited capacity to describe their habitats. How do they see the world? Can we improve our knowledge in regard to that? Another serious problem that we have faced in working in Banff and Jasper is how to integrate aquatic factors into ELC frameworks. Should we even try? A vast amount of research is needed on all these items. I am talking not about management-oriented studies but the scientific type of study that may in fact end up in a big fat report. Hopefully such reports will be focused and containing results that can be applied to greater understanding of animal/habitat relationships. I thought it would never do for anyone with a strong commitment to research to end a topic like this without a comment on research. So there it is!

Questions to Ed Telfer's Summary

Geoff Holroyd: I would just like to add a comment rather than challenge Ed. I would like to thank him for clarifying in my mind what we have been doing and I can certainly see a lot of comments over the last three days fitting into Figure 1. I would like to emphasize two points. One is, the ELC approach as indicated gets us over the correlation hump. I know that is the hump that Kurt has had problems with. That is the sledge hammer he hit us with in 1977 and that was where the thematic inventories stop with the inventory phase and we give the result to somebody and he is supposed to use it but he can't do the correlation so he can't get past that stage. So maybe by using ELC what we are doing is pushing the fog further to the right on Figure 1 but we still have got the fog there. I am not going to show a pass through that fog but I think what some of us do is that we are jumping that correlation stage and entering the fog on the next side without doing that correlation. We are making a quantum leap over that middle canyon on Figure 1 and entering a fog on the other end. Without getting confused in semantics here, we are trying to derive the hypothesis and testing sections without doing that correlation first and so I think that there are two "fog" patches that I can see a way through. There is still a third "fog" which is at the end of the ELC and at the end of the analysis phase in Figure 1 and I am not sure that I see the way through it yet but I think that is what we are heading towards is getting through that third fog.

Ed Telfer: Thanks Geoff. I thought perhaps you were going to say amen to my comments on the need for simplicity in dealing with managers!

Herb Goulden: When Harry talked about the mix of people in the room and he looked at my grey hair when he said it, it is nice to have the old guys with us today! There are two points that I would like to make, and Ed hit on them beautifully. I think the first one is the business of sale of our technology; I am here today not as a technologist but as a salesman. Because I was sent here by my director largely to try to understand what it is we are doing in the ELC so that I can go back and tell him and he can go tell our minister so we can get the money to do it. I think that we all agree that we have some dynamic tools at our fingertips here, but we will never get to use them unless we can sell the whole process. If we are going to sell it we are going to have to stay away from this kind of language. I will just read an example. "Objective number two, to identify the advantages and disadvantages of pursuing an integrated ecological approach to habitat inventory including identification of appropriate and inappropriate integration methods and products and formats". Well, I do not know what that means. I had the great good fortune to be in this business some ten years ago back when we called it biophysical inventory. Nobody understood then what we were doing either! I think that we have to work very, very hard to keep it simple. Keep it in a language that cabinet ministers understand because they are the people that give us the money to do these things.

You know that we have had the great good fortune to have smoother times in the 1970's between the Federal and Provincial governments so therefore there were 50¢ dollars floating around to do a lot of this work. If you listen to Pierre Trudeau and our former Premier Stirling Lyon you will know that those waters are no longer calm and the dollars are no longer flowing in the same magnitude from the Federal coffers or the Provincial coffers.

Speaking as a Provincial civil servant, if we are going to do this kind of work in Manitoba it has got to come out of Provincial funding, although I must say, I am here by the courtesy, in part, of the Federal government. Today I have to be able to convince my premier, my minister and my director that ELC is a good thing to do and that it will provide them with a good way to make resource-use decisions. Thank you Ed. You put it into perspective.

GROUPE DE DISCUSSION I

PROBLÈME

Un barrage d'aménagement hydroélectrique qui inondera jusqu'à la courbe de niveau barquant 2600 pi sera construit sur la rivière Kootenay comme indiqué. L'Hydro offre des dédommagements en argent comptant à la Fish and Wildlife Branch pour la valeur des ressources perdues. La compagnie désire que les fonds soient consacrés à la mise en valeur d'autres habitats dans le secteur.

POINTS À EXAMINER

1. Dans quelle mesure les données d'inventaire fournies permettent-elles de documenter les pertes et le potentiel de mise en valeur des ressources fauniques?

2. Quels renseignements additionnels faudrait-il obtenir pour effectuer ces évaluations?

3. L'échelle des cartes est-elle appropriée?

4. Compte tenu du problème posé, déterminer les principaux points forts et les faiblesses des données.

5. Formuler une série de recommandations pour la préparation d'un ensemble de données idéales sur l'inventaire des habitats qui pourrait servir à la résolution du problème. Indiquer, dans ces recommandations, les échelles appropriées, les informations désirées ainsi que la présentation.

DONNÉES EXAMINÉES

Carte de l'Inventaire des terres du Canada (ITC) pour les ongulés, les oiseaux aquatiques et les pêches.

Cartes biophysiques du ministère de l'Environnement de la Colombie-Britannique.

MEMBRES DU GROUPE DE DISCUSSION

Brian Fuhr (président), David Rimmer (secrétaire), Sean Boyd, Gaétan Guertin, David Poll, Rod Patterson, Marty Beets, Peter Boothroyd, Dennis Jaques, Helen Dudynsky.

RAPPORT ET RECOMMANDATIONS

(corrigés et révisés par David Rimmer et Brian Fuhr)

Points forts et faiblesses des données

Inventaire des terres du Canada

- manque de détails généraux. Il faut des versions à une plus grande échelle de ces cartes pour faire des évaluations plus détaillées que celles à l'échelon régional. Cependant, des cartes à petite échelle (1:250 000) seraient utiles pour l'obtention d'un aperçu général de l'étendue de l'aire d'inondation et de la nature générale ainsi que de la répartition des habitats restants ou créés.

- manque de détails quant aux espèces. Il faut des informations sur un plus large éventail d'espèces, notamment les espèces rares ou menacées, les oiseaux considérés comme gibier des hautes terres et le poisson. Les cartes restreignent l'envergure des recommandations concernant la mise en valeur pour certaines espèces particulières.

- manque de détail sur les habitats. Les informations sur les habitats des cartes en question ont été interprétées à partir de données brutes. Il faut avoir accès aux données brutes pour la comparaison des parcelles d'habitat et pour les négociations.

- manque de données sur l'utilisation actuelle. Les cotes du potentiel ne signifient pas toujours la présence d'espèces. Ces cartes illustrent l'étendue de la perte des habitats mais n'indiquent pas, en fait, si les animaux seront perdus. Par conséquent, les conclusions sur les pertes d'espèces dépendent des circonstances.

- des cartes peuvent être désuètes. Les cartes illustrent les évaluations des habitats au moment où celles-ci ont été faites. Il est important de tenir compte des changements interactifs continus entre les animaux et l'environnement sur le plan écologique et en fonction de nos connaissances à leur sujet.

- manque de données sur l'utilisation des terres actuelles et futures dans la vallée. L'utilisation actuelle des terres limitera le nombre d'habitats disponibles pour la mise en valeur. Par exemple, si les activités agricoles empiètent sur les habitats existants, il n'y aura plus d'habitats à mettre en valeur si le nouveau réservoir empiète sur les terres cultivées.

Cartes biophysiques du ministère de l'Environnement de la Colombie-Britannique

- légende trop complexe. La longueur et la complexité des légendes exigent beaucoup de travail pour comprendre les cartes. Toutefois, à cause de leur complexité, les légendes contiennent beaucoup plus de détails que les légendes simples de l'ITC.

- manque de données sur l'utilisation actuelle. Il n'y a aucune donnée sur l'utilisation actuelle par la faune et, par conséquent, les pertes d'espèces doivent être déduites à partir des pertes d'habitat. La présence de poissons est signalée mais il n'y a pas de renseignements sur l'état des populations (par exemple sédentaire, migrateur), l'étape du cycle évolutif (par exemple frai, juvéniles, adultes) ni l'époque de l'année. Les possibilités de mise en valeur diffèrent grandement en fonction de ces facteurs.

- manque de détails sur les espèces. Comme dans le cas des cartes de l'ITC, les informations portent seulement sur un nombre limité d'espèces, mais les espèces de poisson signalées au moment de l'échantillonnage sont indiquées.

- symbolisme trop perfectionné. Les utilisateurs généraux et occasionnels tireraient profit d'un système de codage plus simple. Néanmoins, après avoir acquis une certaine expérience dans la lecture des cartes, on n'a pas beaucoup de difficulté.

- comporte des éléments et des détails qui font défaut dans les cartes de l'ITC. Les cartes de la Colombie-Britannique donnent des détails sur les loisirs, le relief, la végétation, les sols et les propriétés des cours d'eau en plus de données sur les habitats fauniques. Ainsi, l'évaluation du potentiel de mise en valeur est plus facile, en dépit du manque de données sur l'utilisation des terres (autre que les loisirs).

Besoins en données

Pour la formulation des recommandations quant au potentiel de mise en valeur et aux possibilités offertes après l'inondation de la Kootenay, il serait avantageux de combiner les détails des cartes biophysiques de la Colombie-Britannique aux cartes plus générales de l'ITC. Voici des propositions quant aux améliorations:

- large éventail d'échelles et de détails. Des cartes à petite échelle contenant des informations très générales permettraient l'évaluation des secteurs où la mise en valeur est possible. Les cartes à grande échelle comportant de nombreux détails permettraient l'évaluation des possibilités de mise en valeur particulières aux espèces.

- prise en compte de nombreuses espèces. Il faudrait obtenir des données pertinentes pour toutes les espèces d'importance au plan récréatif et commercial.

- des cartes sur trois sujets particuliers sont nécessaires. Il s'agit de l'utilisation actuelle par toutes les espèces d'intérêt, du potentiel des secteurs perdus, restants et créés pour appuyer les espèces d'intérêt, et de l'utilisation actuelle (et future) des terres par l'homme.

- système de séparation et de combinaison des données suivant les besoins de l'utilisateur. La collecte de données et la cartographie de diverses propriétés devraient être effectuées de concert et devraient faciliter la correction-révision, la manipulation et la superposition par des méthodes manuelles ou informatiques.

- connaissance de l'utilisation des ressources. La valeur d'une espèce (autre que les espèces rares et menacées) se détermine par la demande et par les pressions exercées sur celle-ci, ou les deux. Par conséquent, il faut des cartes comportant des informations sur la demande ou les prises, peut-être sous la forme de valeur en argent. Pour ce qui est de l'amélioration de l'utilisation des ressources, le potentiel des habitats possibles peut être plus important que l'utilisation actuelle des habitats.

SÉANCE PLÉNIÈRE

Kevin Van Tighem: Vous avez mentionné l'utilisation de l'intégration manuelle ou informatisée des calques de superposition des diverses bases de données. Que pensez-vous d'un système de classification qui les intègre toutes? En d'autres termes, avez-vous envisagé un système de classification qui tiendrait compte des sols, de la végétation et des réseaux de drainage et qui les présenterait comme s'il s'agissait d'un seul ensemble?

David Rimmer: Oui, cette possibilité a été envisagée et c'est, je crois, le résultat qu'il faut chercher à obtenir avec l'intégration informatisée ou manuelle des calques de superposition. La superposition et l'intégration informatisées n'équivalent pas à la

simple surimpression des cartes, mais nécessitent la détermination de secteurs qui comportent des éventails prédéterminés de chaque propriété de l'habitat. Il s'agit du mode de classification dont, je crois, vous parlez. Cependant, il en résulte une perte des détails et des légendes complexes sont nécessaires.

Joe Kuhn: Vous avez beaucoup insisté dans vos évaluations, sur la nécessité d'associer l'utilisation actuelle des secteurs par la faune pour évaluer ces mêmes secteurs. Comment expliquez-vous cela, compte tenu du fait qu'il est extrêmement coûteux d'acquérir ces données, notamment si l'on tient compte de plusieurs populations pendant diverses saisons? De plus, au moment de l'évaluation, les populations peuvent être peu nombreuses dans le secteur étudié et ne pas utiliser beaucoup un habitat de qualité. De tels facteurs n'ajoutent rien à une évaluation des terres.

David Rimmer: Suivant mon expérience, la question fondamentale consiste à déterminer les animaux qui se trouvent vraiment dans l'habitat étudié. Les données sur le potentiel d'un habitat sont très utiles, mais il est difficile de protéger un secteur s'il est impossible d'affirmer qu'il s'y trouve des animaux. Du point de vue pratique, il est très important de connaître l'utilisation actuelle des habitats.

Kevin Van Tighem: Il faut faire un compromis. Il faut faire des comptages quelconques dans les secteurs étudiés, mais je ne pense pas que des dénombrements absolus soient nécessaires.

David Rimmer: Les cartes des réseaux hydrologiques de la Colombie-Britannique font état d'un tel compromis. Les cours d'eau sont décrits et, à partir de ces données, le potentiel des habitats peut être évalué. Les cartes indiquent également s'il se trouve du poisson; mais elles ne comportent aucune estimation de la taille des populations. Elles fournissent des données sur le potentiel des habitats et sur l'utilisation actuelle des habitats en question.

Kevin Van Tighem: Peu importe le nombre réel d'animaux; il est raisonnable de dire, au plan théorique, que l'habitat le plus important regroupera la plus forte densité d'animaux. Il faut faire des dénombrements et ensuite, coter les habitats compte tenu des dénombrements effectués plutôt qu'en se basant sur la productivité déduite. En d'autres termes, un véritable dénombrement est nécessaire, mais il devrait se limiter à un système de cotation approprié, peu importe la densité de la population à n'importe quel moment.

David Rimmer: C'est justement ce que j'allais dire. On peut indiquer le potentiel d'un secteur mais on devrait également indiquer les populations qui utilisent actuellement le secteur en question. Les données historiques pourraient peut-être aider à préciser les différences entre l'utilisation actuelle et le potentiel. Joe Kuhn a mentionné que des secteurs ayant un potentiel élevé peuvent ne pas être utilisés pendant un certain nombre d'années. Il peut être nécessaire de reculer plusieurs années pour observer une tendance.

Harry Stelfox: Il est possible que les planificateurs n'approuvent pas un si grand nombre de cartes différentes portant de nombreuses lignes représentant les différentes composantes du paysage. Pour une évaluation détaillée des incidences environnementales, il est utile d'indiquer des séparations et de nombreux détails; mais, s'il s'agit d'un problème de planification mettant en cause différents secteurs et problèmes de gestion des ressources, ce genre de document paraît extrêmement encombrant. Ma question devrait peut-être s'adresser à Brian Fuhr qui vient de la Colombie-Britannique et qui est bien au courant du programme biophysique de cette province. Est-ce que ce programme est conçu pour la planification, et pensez-vous que son application pose des problèmes?

Brian Fuhr: Les cartes, sous leur forme actuelle, ne sont pas conçues pour l'évaluation des incidences; elles sont conçues en fonction de la gestion. Certaines cartes sont produites à partir de cartes sur les sols et le relief donc, bien qu'il semble y avoir de nombreuses cartes, elles ne sont pas toutes produites indépendamment. Si vous devez faire une évaluation des incidences, il se peut que vous ne vous intéressiez qu'à un aspect de l'évaluation par exemple le relief, les sols, la végétation, la faune, les pêches ou les loisirs, d'où l'importance de cartes distinctes. Pour une évaluation globale des incidences, je ne pense pas que les cartes seraient présentées de cette façon. Tout à l'heure, j'étais sur le point de parler de l'évaluation du potentiel et des incidences. Ce sont là deux composantes de l'évaluation des ressources. Premièrement, quelles sont les espèces en cause et combien d'individus les populations regroupent-elles actuellement; deuxièmement, quel est le potentiel des terres en question pour l'appui des animaux. Le potentiel est un élément de caractère hypothétique, représentant une valeur optionnelle qui est très importante en tant que ressource publique. La perte de cette valeur, tout autant que la perte des animaux, est importante pour la gestion future.

Christine Boyd: Compte tenu des sujets traités et de la confusion qui règne dans ce domaine, est-ce que cela peut être considéré comme un produit de la CET? À mon avis, cela m'apparaît comme le traitement biophysique d'un seul secteur.

Brian Fuhr: Il s'agit d'un produit de la CET dans un sens large; les lignes sont similaires sur les cartes du potentiel pour les ongulés et les sols. Il ne s'agit pas strictement d'une CET, mais les principes sous-jacents à la production sont les mêmes. Les cartes sur la faune et les loisirs sont tracées à partir des cartes sur les sols. Étant donné que la carte sur la faune est une carte de potentiel, des unités similaires ont le même potentiel, même si elles comportent différents stades sériaux. C'est la raison pour laquelle la carte des sols, plutôt que la carte de la végétation, est utilisée à la base.

Kevin Van Tighem: Est-ce que le potentiel faunique est évalué en mesurant les paramètres fauniques ou est-il évalué compte tenu de la productivité prévue des sols?

Brian Fuhr: L'évaluation se fait d'après ces deux éléments. Il est impossible de considérer la productivité végétale basée sur le sol sans également considérer la faune, l'utilisation de l'habitat et les caractéristiques écologiques du secteur. Les potentiels sont classés d'après des secteurs de base, c'est-à-dire des secteurs dont l'utilisation courante semble illustrer le potentiel. Par exemple, un brûlis peu élevé peut se trouver dans un secteur ayant une bonne condition sériale (ce que nous considérons comme une bonne condition sériale pour le wapiti) et grandement utilisé actuellement par le wapiti. Il est possible de déterminer le nombre d'animaux qui utilisent le secteur en question et, à l'aide des données historiques, d'utiliser ce secteur comme base pour faire des extrapolations concernant d'autres secteurs ayant des sols similaires mais dont la condition sériale est moins productive et différente. Bien entendu, cela n'est possible que si d'autres paramètres, par exemple le climat et le paysage, sont similaires dans chaque secteur. Cependant, cela ne devrait pas poser de problèmes étant donné que les changements dans le climat ou le paysage se réfléteront dans le type de sol. Il faut dessiner des cartes des sols en fonction des aspects écologiques.

Christine Boyd: Est-ce que vous avez évalué la faune seulement d'après les sols ou avez-vous tenu compte d'autres éléments, par exemple les secteurs servant de couvert de refuge?

Brian Fuhr: Il est impossible d'évaluer la faune en tenant compte seulement des sols. Il faut tenir compte des besoins écologiques de chaque espèce. Les moutons et les chèvres ont besoin de couverts de refuge près des aires de pâturage. Le cerf mulet préfère le relief irrégulier contrairement au cerf de Virginie qui préfère les terrains réguliers. Il faut tenir compte de la position du secteur étudié par rapport au paysage.

Christine Boyd: Est-ce que cela comprend l'emplacement des unités par rapport aux autres unités?

Brian Fuhr: Oui.

Doug Meeking: Vous avez mentionné que les cartes de l'ITC étaient vieillies et que cela posait des restrictions. Je soulève ce point parce que l'ITC est conçu pour la production des données particulières qui ne changeront pas pendant 10 ans.

Brian Fuhr: Nous les considérons comme vieillies dans le sens que, lorsqu'une carte de potentiel est produite à un moment donné, l'interprétation de l'habitat d'une espèce faunique se fonde sur les connaissances de leurs exigences écologiques d'alors. À mesure que les connaissances sur ces exigences augmentent, l'habitat choisi comme étant important peut changer. Certains d'entre nous avaient des cartes de l'ITC qui n'étaient pas utiles, non pas à cause de changements sériaux, mais parce que nos idées en matière d'écologie avaient changé. Nous avions aussi certaines réserves quant à certains aspects des méthodes utilisées.

Harry Stelfox: Est-ce que l'ensemble des lignes pour le couvert végétal est différent de l'ensemble des lignes pour les sols? Y a-t-il intégration des sols et de la végétation dans les limites d'une unité de carte commune?

Brian Fuhr: Les cartes de végétation récentes portent des lignes qui correspondent aux lignes des sols, mais comportent des subdivisions pour les changements dans le stade sérial. Celles-ci décrivent le paysage végétal, les unités dont la progression sériale au plan de la végétation est similaire. Dans l'exemple cité, les sols changent suivant les limites de zone et, dans ce sens, on peut dire qu'ils ont été intégrés.

GROUPE DE DISCUSSION II

PROBLÈME

Un fermier qui loue comme pâturage 640 acres de terres n'ayant fait l'objet d'aucune amélioration, vient de faire une demande aux autorités provinciales pour avoir le droit d'améliorer le potentiel de paissance des terres en question. Il propose d'enlever tous les arbres et les arbrisseaux et d'ensemencer 160 acres en pâturage. Actuellement, les terres louées supportent un peuplement mélangé, des prairies naturelles ainsi que des terres humides peu profondes. De plus, un petit ruisseau à truites serpente dans la moitié sud du terrain en question. Le biologiste régional de la faune est responsable de l'imposition de restrictions et de modifications au projet d'amélioration de façon à ce que seulement 320 acres fassent l'objet de travaux et que les incidences sur les ressources fauniques soient minimisées. Le biologiste des habitats devra prêter une grande attention à la juxtaposition des valeurs liées aux habitats des secteurs environnants.

POINTS À EXAMINER

1. Dans quelle mesure les données d'inventaire fournies permettent-elles la détermination des valeurs fauniques des terres louées et des modifications à apporter de façon à minimiser les incidences?

2. Quels types de renseignements additionnels seront nécessaires au biologiste régional?

3. L'échelle des cartes est-elle appropriée?

4. Compte tenu du problème qui se présente, déterminer les points forts et les faiblesses des données.

5. Formuler une série de recommandations pour la préparation d'un ensemble de données idéales sur l'inventaire des habitats visés, que l'on pourrait utiliser pour résoudre le problème. Déterminer dans ces recommandations les échelles appropriées, les informations désirées et la présentation.

DONNÉES EXAMINÉES

Cartes de l'ITC pour les ongulés, les oiseaux aquatiques et les pêches.
Cartes et rapport des inventaires des habitats terrestres et des terres humides de la Saskatchewan.

MEMBRES DU GROUPE DE DISCUSSION

Herb Goulden (président), Patricia Flory (secrétaire), Glen Adams, Al Bibaud, Kevin Van Tighem.

RAPPORT ET RECOMMANDATIONS

(corrigés et révisés par Patricia Flory et Herb Goulden)

Faiblesses des données

Inventaire des terres du Canada (ITC)

- pas assez de détails. Il faut une carte à plus grande échelle. Cependant, il contient des indications sur la population faunique de tout le secteur.

- besoin en données sur un plus grand nombre d'espèces fauniques par exemple les oiseaux considérés comme gibier des terres hautes; les espèces uniques, rares ou menacées d'extinction; les animaux à fourrure.

- la cartographie présente des contradictions quant au potentiel et à l'utilisation actuelle des terres.

- l'ITC indique ce qu'il est possible de faire sur les terres, mais n'indique pas ce que l'on peut se permettre de perdre.

- manque de données sur l'utilisation des terres pour le secteur en question et les zones environnantes.

- impossibilité d'évaluer l'habitat en question dans le contexte régional.

- nécessité d'avoir accès aux données brutes - pour comparer la valeur relative de la parcelle en question avec celle des aires environnantes.

- l'ITC se fonde sur la fertilité au plan agricole, facteur qui ne correspond pas directement au potentiel des habitats. Exemple: les terres sablonneuses sont médiocres pour l'agriculture mais excellentes pour la faune.

- les données de l'ITC aident à établir l'ordre de priorité des habitats. En se fondant sur l'ITC, il est possible de

déterminer si l'habitat est peu étendu et unique quant à son potentiel ou s'il fait partie d'un grand secteur homogène et, peut-être, improductif.

- l'ITC ne comporte pas suffisamment de données sur l'utilisation et la pertinence, au plan faunique, pour un large éventail d'espèces, de données sur les sols, et de données sur l'utilisation des terres. Ces renseignements pourraient être fournis sur des cartes à l'échelle 1:50 000 indiquant les unités de la CET. Chaque quartier devrait comporter des calques de superposition sur l'utilisation des terres, l'utilisation par la faune, etc.

Inventaire des habitats fauniques terrestres

- certaines espèces fauniques, par exemple le poisson, ne sont pas prises en compte dans le cadre de cet inventaire, en dépit de la présence de données suffisantes sur les sols et la topographie permettant une gestion judicieuse de l'utilisation des terres qui se refléterait dans la gestion des pêches. Exemple: des données suffisantes sont fournies pour permettre une estimation du potentiel du ruisseau pour la production de truites.

- l'inventaire comporte suffisamment de détails sur l'utilisation des terres, les propriétaires, les habitats disponibles (pour un large éventail d'espèces utilisant les habitats terrestres et les terres humides), et la densité des terres humides pour permettre au biologiste d'examiner une parcelle en particulier par rapport au secteur environnant; c'est-à-dire, le biologiste est en mesure de décider s'il doit permettre le défrichement.

- pas suffisamment de détails (échelle trop petite) pour permettre la prise de décisions sur l'emplacement et la dimension des aires à défricher. Ces renseignements sont nécessaires pour minimiser les incidences nuisibles du développement agricole et, peut-être, pour permettre la mise en valeur de l'habitat.

- les cartes de l'inventaire des habitats fauniques terrestres sont utiles pour les relations publiques. Exemple: les cultivateurs aiment voir où se trouvent leurs terres par rapport à l'ensemble. Cependant, il est décourageant d'avoir à utiliser une série de sept cartes, et de ce fait, leur utilisation par les biologistes régionaux qui n'ont pas le temps ou la formation nécessaire pour les interpréter de façon appropriée peut s'en trouver limitée.

Besoins en ressources

Idéalement, pour s'occuper d'un tel problème, le biologiste devrait avoir une série de cartes similaires, au plan de l'échelle et du contenu, aux cartes de l'inventaire des habitats fauniques terrestres auxquelles les modifications suivantes seraient apportées:

- informatiser les données pour permettre une mise à jour rapide et facile.

- éliminer les cartes de densité des terres humides et incorporer les données sur la carte des systèmes terrestres ou produire une carte de la classification biophysique des terres humides indiquant l'aridité, la permanence, l'espacement.

- prendre en compte un plus grand nombre d'espèces fauniques, c'est-à-dire le poisson.

- à la place d'une carte des habitats fauniques de première importance, produire une carte des habitats sur laquelle chaque parcelle de terre est cotée (bon, moyen et médiocre) pour les diverses espèces à l'étude.

- éliminer le rapport ou en réduire la dimension - imprimer les recommandations quant à la faune en marge ou au verso de la carte. Produire un rapport sommaire moins détaillé portant sur un secteur plus étendu, c'est-à-dire ne pas produire un rapport avec chaque carte.

En plus de ce qui précède, une carte détaillée des sols et une carte à l'échelle 1:15 000 (peut-être une carte numérique Landsat) indiquant la végétation actuelle et la topographie ou les écosites doivent être utilisés.

Compte tenu du type de données décrites, il serait possible d'assurer la mise en oeuvre de bonnes pratiques de gestion des terres, y compris la maximisation des bordures, le maintien des aires de nidification des hautes terres, la modération du défrichage, la conception de secteurs défrichés non linéaires (de forme polygonale), l'interruption des sentiers du gibier, la détermination de l'emplacement approprié et du type de clairières (ensemencées et/ou fertilisées), l'augmentation de la diversité, la protection des habitats fragiles (par exemple le ruisseau et, notamment, la héronnière qui s'y trouve) et la réduction des incidences de la chasse.

SÉANCE PLÉNIÈRE

Paul Gray: Dans le nord-ouest de l'Ontario et dans le nord de certaines des provinces où se trouvent d'importantes aires d'exploitation forestière commerciale, une technique utilisée consiste à maximiser les bordures en modifiant radicalement les limites des blocs ou zones de coupe de façon à obtenir un grand nombre de formes et même des aires résiduelles dans les limites des zones. Est-ce que le cultivateur s'objecterait à contourner les bordures des clairières déterminées?

Pat Flory: Est-ce que vous voulez dire que ces limites seraient sinueuses? Cela pourrait être acceptable dans les secteurs ensemencés en fourrage pour les animaux domestiques si le cultivateur ne prévoit pas récolter le foin dans les champs en question, mais dans la plupart des cas, il ne serait pas pratique d'utiliser une herse à disques ou un semoir le long de bordures compliquées. Nous essayons de maximiser les bordures dans notre plan d'aménagement en gardant des blocs de petite dimension, en leur donnant une forme polygonale et en maintenant toutes les trouées dans leur état naturel.

Paul Gray: Est-ce que vous avez parlé de la dimension des blocs? Des travaux ont été faits à ce sujet et certains résultats indiquent que l'orignal, par exemple, s'aventurera dans une certaine mesure dans les trouées mais n'ira pas très loin à moins que des zones résiduelles n'aient été gardées à son intention. Je me demande simplement si c'est le cas actuellement et par conséquent, cela influerait sur la dimension des blocs.

Pat Flory: Bien, en fait, nous n'avions pas pour mandat d'élaborer un plan possible pour cette parcelle de terre en particulier. Je ne sais pas quelle est la meilleure dimension des clairières pour le cerf de Virginie ou pour la gélinotte à queue fine, mais dans ce cas, nous ne nous occupons que d'une parcelle de 640 acres que nous divisons en unités relativement petites pour amélioration. Selon moi, ces unités sont de taille à ce que le cultivateur les accepte et ne sont pas assez grandes pour empêcher l'utilisation du secteur par le cerf. Nous avons également beaucoup de bordures que la gélinotte à queue fine peut utiliser. Nous sommes d'avis que, étant donné que le reste du secteur est couvert de forêt, ce type d'aménagement peut même améliorer l'habitat, dans une certaine mesure. Il n'y aurait pas de perte totale du potentiel en matière d'habitat dans les secteurs étudiés.

Paul Gray: Vous pourriez également aménager la forêt. Vous pourriez éliminer certains secteurs de forêt-climax.

Pat Flory: Oui. J'ai oublié de mentionner tout à l'heure que même avec les données d'inventaire que nous considérons comme idéales, le biologiste devrait quand même passer du temps sur le terrain, non seulement pour des vérifications mais également pour améliorer les relations publiques.

Mark Wride: Avez-vous envisagé l'utilisation de photographies aériennes en plus des cartes disponibles étant donné les petites dimensions de l'aire examinée?

Pat Flory: Je ne l'ai pas mentionné dans le rapport, mais nous avons examiné cette question. Selon moi, avec une carte numérique Landsat indiquant la végétation et la topographie, il devrait être possible de réduire l'interprétation de photos aériennes que devraient faire les écologistes régionaux. Je ne travaillerais jamais sans photos aériennes donc, je ne peux pas dire de ne pas les utiliser.

Mark Wride: Selon moi, dans certains cas, les cartes Landsat sont utiles mais pour un secteur de un mille sur un mille, si vous avez une photographie aérienne, vous seriez mieux en mesure de traiter avec le cultivateur et de lui montrer exactement sur la photographie ce dont vous vous occupez. Si des photographies non coûteuses sont disponibles, selon moi, elles pourraient constituer un élément très important, quoique nous aimerions également parler du matériel et des données perfectionnées.

Pat Flory: Ce que vous dites, en fait, c'est qu'un inventaire des habitats fauniques terrestres légèrement modifié serait le produit idéal dans ce cas-ci; vous utilisez les photos aériennes seulement pour une analyse détaillée de la végétation. Dans ce cas, nous n'aurions pas besoin d'une nouvelle carte.

Mark Wride: Je pense que la série des cartes des habitats terrestres à l'échelle 1:250 000 est conçue pour un secteur beaucoup plus grand que celui dont nous nous occupons actuellement. C'est une bonne échelle pour une vue d'ensemble, mais je ne pense pas que je voudrais travailler sur un secteur d'un mille sur un mille avec des cartes à petite échelle, par exemple 1:250 000.

Pat Flory: Donc, vous ne voudriez pas de carte à l'échelle 1:250 000.

Mark Wride: Je l'utiliserais pour une vue d'ensemble mais je ne ferais pas mon plan d'aménagement sans avoir une photographie aérienne à l'échelle 1:10 000 ou 1:20 000, si je pouvais l'obtenir.

Pat Flory: Donc, vous n'utiliseriez l'inventaire que pour avoir une vue d'ensemble et ensuite, vous utiliseriez des photographies aériennes à basse altitude pour les travaux ponctuels? C'est exactement ce que nous faisons actuellement en Saskatchewan.

Dennis Wright: J'aimerais avoir davantage de détails sur vos plans concernant le pont sur le ruisseau. En donnant accès au bétail sans protéger le ruisseau de façon appropriée, vous pourriez annuler tout ce que vous essayez de protéger en aménageant une clôture pour limiter l'accès du bétail au ruisseau.

Pat Flory: Al Bibaud a mentionné la possibilité d'un enrochement à l'endroit où le bétail accéderait au ruisseau et de la construction d'un pont qui ne perturberait pas le cours d'eau en question. Ainsi, le bétail aurait accès à la partie sud du secteur, si désiré. Le cultivateur peut s'objecter à l'installation de clôtures, par exemple, autour d'un quart de ses terres juste pour protéger le ruisseau et la héronnière. De cette façon, il est possible de lui permettre d'utiliser davantage sa propriété. Idéalement, il n'y aurait pas de passage pour le bétail.

Herb Goulden: Al Bibaud et moi-même avons beaucoup travaillé avec des cultivateurs et, suivant notre expérience, les biologistes ne sont pas très habiles lorsqu'il s'agit de négociations et ils ne sont pas persuasifs. Selon nous, les deux points les plus importants consistent à être persuasif, c'est-à-dire que nous devrions faire accepter l'idée d'une carte des habitats terrestres au biologiste local pour qu'il puisse savoir comment l'utiliser; deuxièmement, nous espérons que le biologiste local est un gestionnaire des terres pratique et réaliste. Pour ce qui est du passage sur le ruisseau, je pense que Pat n'a pas bien saisi ce dont nous parlions, c'est-à-dire simplement de limiter l'accès du bétail à l'aide d'une clôture.

GROUPE DE DISCUSSION III

PROBLÈME

Un biologiste est chargé de préparer un plan exhaustif d'établissement des buts pour le poisson et les ressources fauniques dans un territoire donné. Ce plan assurera l'orientation de la protection et de la mise en valeur du poisson et des ressources fauniques au cours des 20 prochaines années. Le plan doit préciser, pour le territoire donné, les renseignements suivants:

1. Population actuelle des espèces prioritaires et des groupes d'espèces.

2. Terres actuelles dont dépendent les animaux.

3. Terres potentiellement utilisables et nécessaires pour appuyer les populations animales futures prévues dans le plan de protection et de mise en valeur.

POINTS À EXAMINER

1. Dans quelle mesure les données fournies permettent-elles la documentation des données sur les habitats actuels et potentiels (terres) et les populations animales nécessaires pour ce plan provincial?

2. Quelles informations additionnelles faudrait-il obtenir pour réaliser ces évaluations?

3. L'échelle des cartes est-elle appropriée?

4. Compte tenu du problème posé, déterminer les points forts et les faiblesses des données.

5. Formuler une série de recommandations pour la préparation d'un ensemble de données idéales sur l'inventaire des habitats qui pourrait être utilisé pour résoudre le problème. Déterminer dans ces recommandations les échelles appropriées, les informations désirées et la présentation.

DONNÉES EXAMINÉES

Cartes de la Série d'information sur l'utilisation des terres nordiques, cartes de l'inventaire des habitats fauniques et carte du relevé écologique des terres du Nord pour le nord du Yukon.

MEMBRES DU GROUPE DE DISCUSSION

Paul A. Gray (président), George Collin (secrétaire), Dennis G. Wright, Keith Yonge, Jack Millar, Peter Achuff, Shirley Nelson, Dennis Demarchi, Marion Porter et Joe A. Kuhn.

RAPPORT ET RECOMMANDATIONS

(corrigés et révisés par G. Collin et P.A. Gray)

Faiblesses des données

1. Cartes de la Série d'information sur l'utilisation des terres nordiques

a) besoin de références pour l'évaluation de la fiabilité et de l'exactitude des données.

b) aucune donnée quantitative pour l'évaluation de la répartition et des populations fauniques.

c) aucune indication quant aux aires d'aménagement et de protection prioritaires, aucune donnée quant aux espèces prioritaires dans des secteurs particuliers.

d) aucune donnée sur l'utilisation ou la disponibilité des habitats.

e) grand nombre de symboles uniques, d'où difficultés pour l'interprétation des cartes.

f) les données sur l'utilisation, au plan culturel, des terres ne sont pas à jour.

2. Cartes de l'inventaire des habitats fauniques du nord du Yukon

a) les habitats ne sont liés à aucune unité particulière pouvant être aménagée.

b) cotes attribuées subjectivement aux habitats seulement; aucune mention des critères utilisés pour coter les habitats.

c) unité fondée sur une seule ressource non intégrée aux autres formes d'utilisation des terres.

3. Carte du relevé écologique des terres du Nord pour le nord du Yukon

a) l'intégration de l'utilisation par la faune aux unités écologiques n'est pas clairement déterminée.

b) nécessité d'intégrer les classes de végétation utilisées pour la détermination des unités de la classification écologique du territoire (CET) aux unités des habitats fauniques.

Discussion

La discussion porte principalement sur les besoins en données pour la planification à long terme concernant la faune dans le Nord. Les représentants d'organismes responsables de la gestion de la faune dans le Nord (nord du 60° parallèle) ont exprimé des vues différentes, quant aux besoins en informations et aux cartes souhaitées, de celles des gestionnaires de la faune qui travaillent dans le sud du Canada. Parmi les principaux problèmes discutés citons: qualité des données sur la faune (quantitatif et qualitatif), échelle des cartes écologiques (écorégion et écosection), envergure des cartes des habitats et des espèces fauniques (plusieurs espèces et une seule espèce) et rôle des biologistes de la faune dans la préparation des cartes de la CET (membres de l'équipe et utilisateurs des unités de classification des terres obtenues). Généralement, les gestionnaires du Nord semblent avoir besoin de données de nature plus générale étant donné les grands territoires dont ils sont responsables. Les gestionnaires de la faune travaillant dans le sud du pays désirent obtenir des données d'inventaire plus détaillées à cause de l'exploitation intensive des ressources fauniques dans le Sud.

Recommandations

1. Une démarche normalisée face aux méthodes d'évaluation des habitats est nécessaire et devrait être conforme au système de classification de la végétation utilisé pour les unités de la CET. Il faudrait établir un comité qui serait chargé d'accomplir cette tâche.

2. Pour la planification des programmes fauniques dans les secteurs faisant l'objet d'une exploitation intensive des ressources, il faut davantage de données quantitatives pour évaluer la disponibilité et l'état des habitats.

3. Des renseignements sur l'utilisation à long terme, au plan culturel, des ressources fauniques sont nécessaires pour la planification efficace de ces ressources.

4. Il faudrait établir un système informatisé d'entreposage et d'extraction de données géographiques qui faciliterait l'intégration de différents ensembles de données pour accroître la souplesse de l'utilisation.

SÉANCE PLÉNIÈRE

Ed Oswald: Je suis le président du groupe de travail national de classification de la végétation, j'ai besoin de connaître le type de données que vous aimeriez voir inscrire sur les cartes de classification de la végétation. Est-ce que les types de végétation indiqués pour les diverses unités (écosite) sont appropriés, ou avez-vous besoin de renseignements plus précis, par exemple classes de hauteur et de densité?

Harry Stelfox: Vos remarques sont les bienvenues, je pense que ces genres de préoccupations et d'intérêts se manifesteront au cours de notre réunion à l'égard des activités que nous devrions poursuivre en tant que groupe de travail chargé de la faune. Pour revenir à ce que vous disiez, George, je pense qu'il s'agit d'un point important quant aux composantes qualitatives et quantitatives d'une base de données. Vous soulevez certains des problèmes auxquels nous faisons face en ce qui concerne les définitions et la terminologie ainsi que l'utilisation de termes tels que fragile et primordial ou bien le meilleur ou très bon. Les évaluations qualitatives sont difficiles à examiner d'un oeil critique et à refaire de façon objective. Finalement, les gestionnaires désirent savoir ce que ces termes signifient par rapport aux populations fauniques.

George Collin: Je pense que vous avez raison lorsque nous examinons ce problème dans le contexte de la gestion dans le sud du Canada. Selon moi, comme démarche préliminaire de la planification à long terme, il faut utiliser les données qualitatives initiales et s'en servir comme base pour l'élaboration des plans. Ensuite, à mesure que les besoins surgissent, davantage de données quantitatives peuvent être recueillies et incorporées au plan.

Joe Kuhn: En gros, je suis du même avis. Dans le cas d'un inventaire pour la classification écologique des terres du Yukon regroupant 250 cartes, je suis d'avis que l'analyse qualitative de la valeur des espèces individuelles ou des groupes d'espèces constitue la meilleure méthode à suivre. Les remarques de Harry sont pertinentes pour les évaluations des incidences, lorsque vous travaillez à un projet de développement et que vous demandez au promoteur d'utiliser des cartes à l'échelle de 1:50 000. Alors, je pense qu'il est important

de quantifier les unités associées aux types de terres. Selon moi, les échelles, et non l'emplacement géographique, font la différence quand il s'agit de déterminer s'il faut effectuer une analyse qualitative ou quantitative.

Kevin Van Tighen: Si la planification porte sur 20 ans, selon moi, il faut se préoccuper de la collecte de données exactes et quantitatives. Il faut des données quantitatives (même si ce n'est qu'un simple système de cotation haut/bas) sur lesquelles fonder les décisions.

Paul Gray: Si vous établissez un système de cotation, alors vous créez une hiérarchie; par conséquent, vous devez définir chaque niveau de cette hiérarchie de façon quantitative. D'après moi, nous devrions travailler à l'établissement d'une démarche normalisée pour les méthodes d'évaluation des habitats qui nous aidera à élaborer des critères appropriés de sélection des habitats.

GROUPE DE DISCUSSION IV

PROBLÈME

On charge un planificateur des ressources naturelles de coordonner la planification intégrée de l'aménagement dans un important bassin hydrographique à forêt mélangée. Ce travail sera fait par une équipe de spécialistes de l'agriculture, de la foresterie, des loisirs, du poisson et de la faune, à l'échelle cartographique de 1/100 000, et portera sur environ 65 cantons. L'équipe devra surtout tenir compte:

1. de l'extension de l'agriculture dans les forêts domaniales périphériques.
2. d'un accord imminent, entre le gouvernement et une entreprise privée, pour la récolte forestière à une vaste échelle.
3. de la protection et de la mise en valeur des possibilités notables de loisirs dans la région, y compris des populations exploitables de plusieurs espèces halieutiques et fauniques.
4. du maintien des populations prioritaires de poissons et d'animaux sauvages et de leurs habitats essentiels.

POINTS À EXAMINER

1. Dans quelle mesure les inventaires (dont les résultats sont fournis) permettent-ils de connaître les ressources halieutiques et fauniques (actuelles et potentielles) de la région à aménager, de sorte qu'on peut protéger et valoriser ces ressources par le schéma intégré d'aménagement?

2. Quels sont les types de renseignements supplémentaires dont aura besoin, dans l'équipe, le spécialiste du poisson et de la faune?

3. L'échelle cartographique des inventaires convient-elle?

4. Connaissant ces problèmes, quels sont les principaux points forts et points faibles des inventaires?

5. Préparer une série de recommandations pour la préparation d'un inventaire idéal des habitats qui pourra servir à résoudre le problème. Préciser le ou les échelles cartographiques convenables, la teneur en renseignements et la forme de présentation.

DONNÉES EXAMINÉES

1. Cartes des régions vitales pour la faune de l'Alberta et cartes de la collection Inventaire des terres du Canada pour les ongulés, les animaux à fourrure, la sauvagine et la pêche.

2. Cartes d'inventaire des habitats terrestres et des terres humides de la Saskatchewan et rapport annexe.

MEMBRES DU GROUPE DE DISCUSSION

Bob Ferguson, Geoff Holroyd, Doug Meeking, Wayne Nordstrom, Kurt Seel, David Taylor (président et rédacteur), Ed Telfer, Peter Van Eck, Eric Watton, Marc Wride.

RAPPORT ET RECOMMANDATIONS

(Revu par David Taylor)

<u>Carences des documents de base</u>

<u>Cartes de l'Inventaire des terres du Canada (ITC) et de la faune de l'Alberta</u>

Les cartes ne portaient pas toute l'information nécessaire à la solution du problème. Des habitats potentiels de certaines espèces y étaient délimités, ce qui pouvait servir à une première stratification en vue d'études ultérieures des habitats ou des populations. L'échelle (1/250 000) convenait, le schéma final devant être à 1/100 000. Comme les cartes faisaient partie d'une collection nationale, on pouvait, afin d'évaluer l'utilité de leurs renseignements, les comparer à celles d'autres régions où des projets similaires avaient été entrepris.

Une carence notable était l'absence d'un fond de carte commun. Chaque carte portait un ensemble différent de polygones cotés en fonction de l'espèce ou du thème d'intérêt, ce qui compliquait l'integration des données. De plus, une foule de renseignements considérés comme essentiels à la solution du problème manquaient, entre autres sur:

- la couverture végétale, d'une façon suffisamment détaillée pour les besoins du biologiste de même que de ceux qui s'intéressent à la classification des possibilités forestières;

- les possibilités agricoles et récréatives;

- les formes actuelles d'utilisation et de propriété des terres;

- le poisson, son habitat, les matériaux de surface, l'hydrologie, l'historique des incendies et les risques d'inondation;

- les caractéristiques de la couverture de neige, élément considéré comme important si les ongulés devaient être gérés.

Inventaire des habitats fauniques terrestres

Cet inventaire véhiculait des renseignements tout à fait satisfaisants comparativement à ceux des documents dont nous venons de parler. Encore une fois, l'échelle, 1/250 000, était considérée comme convenable. Un fond de carte cohérent, au niveau de l'écosystème, servait à un ensemble de classifications thématiques supplémentaires. Ces cartes étaient à la même échelle et étaient accompagnées d'un rapport descriptif. Ceci facilitait considérablement l'intégration des données.

Une seule carte portait des renseignements que le groupe a qualifiés de première main, le reste étant des données dérivées ou des interprétations. On a pensé que beaucoup plus de données de première main auraient dû être cartographiées pour permettre aux utilisateurs leur propre interprétation, selon leurs besoins. Enfin, on a noté que les renseignements sur le poisson et son habitat manquaient complètement et que les données sur la végétation primaire, bien que présentées dans le rapport, auraient dû être cartographiées.

Documentation requise

L'inventaire idéal des habitats découlerait d'un fond de carte normalisé et de données de première main (c'est-à-dire sur la végétation, la pédologie, les matériaux de surface, l'hydrologie, etc.) qui auraient servi à y délimiter des polygones et seraient présentées de façon à pouvoir en dériver des cartes d'interprétation afin de s'attacher, dans le cas qui nous intéresse, à des préoccupations d'ordre faunique, agricole, forestier et récréatif. Dans les lignes qui suivent, on déterminera les façons de procéder et les types d'information nécessaires à l'obtention d'un tel document, compte tenu du problème soumis.

On a pensé que la solution optimale était de passer par la classification écologique du territoire. Dès qu'on aurait énoncé clairement le problème et déterminé les besoins des utilisateurs, on réunirait l'équipe de classification du territoire. Cette équipe aurait un chef indépendant (qui n'est pas le planificateur des ressources dont il a été question dans l'exposé initial du problème) qui n'a pas besoin d'être l'un de ses spécialistes (hydrologiste, pédologue, phyto-écologiste, biologiste des habitats fauniques terrestres, biologiste-halieute et planificateur des loisirs). L'hydrologiste devrait posséder certaines compétences en climatologie tandis que le planificateur des loisirs servirait de planificateur de l'utilisation générale des terres au cours du projet.

Le produit final devant être présenté à l'échelle de 1/100 000, il a été décidé que l'échelle de travail serait de 1/50 000. À cette étape, on aurait à décider de l'emploi ou non d'un ordinateur pour le traitement, le stockage et la manipulation de l'information. L'utilisation d'un ordinateur pour le traitement et la présentation des renseignements numériques et/ou graphiques touche à la fois ceux qui font l'étude et les utilisateurs des résultats de cette étude.

L'équipe entreprendrait alors l'examen des renseignements existants sur la région pour mettre au point les méthodes, la classification, les légendes et conventions cartographiques, etc. à utiliser avant le prétypage des photographies aériennes et des autres images de télédétection. C'est à cette étape que le travail d'équipe prend son sens. Chaque membre doit savoir quelle information fournir pour répondre aux besoins du reste de l'équipe. L'information nécessaire à la mise sur pied d'une base de données pour l'inventaire des habitats fauniques et les autres sujets de préoccupation de la planification des ressources énumérées dans l'énoncé du problème ont été identifiés comme suit:

- descriptions de la végétation actuelle y compris de sa structure, de ses formes et de ses associations;

- descriptions de la végétation climacique prévue à partir de son étape actuelle d'évolution;

- descriptions de la topographie, y compris de la pente et de l'exposition, en relation avec les données sur les matériaux de surface, stratifiées selon les formes de terrain;

- classification des sols, conforme à celle de la Commission canadienne de pédologie;

- descriptions des conditions climatologiques à tirer des sources existantes et intégrées aux résultats des études hydrologiques;

- descriptions des formes actuelles d'occupation des habitats (et non pas dénombrements de populations) pour les espèces à gérer ou d'une valeur particulière pour l'interprétation; et

- descriptions des utilisations actuelles et potentielles des terres à des fins récréatives ainsi que renseignements sur les formes actuelles de propriété et d'utilisation générale des terres.

Aucun consensus clair sur le type d'information sur la pêche et les habitats du poisson n'a été atteint. Le rapport entre l'habitat des poissons et les autres types de données semblait suffisamment obscur pour justifier la production d'un calque cartographique distinct sur cet aspect. Si c'était possible, les relations entre l'habitat des poissons et les autres données des relevés écologiques du territoire devraient être discustées dans un rapport annexe.

Dès que les limites des unités écologiques du territoire sont prétypées conformément aux critères et méthodes convenus, le travail sur le terrain peut commencer. Il s'agit de vérifier la validité de la classification et du prétypage. On peut alors apporter les dernières retouches à la classification et aux limites des unités écologiques.

Comme il a été mentionné plus tôt, les données de première main devraient être présentées en association avec la carte de classification écologique du territoire. Chaque unité serait décrite d'après la végétation, la pédologie, les matériaux de surface, les utilisations par la faune, etc.

Cette information serait complémentée par une annexe dans laquelle on trouverait:

- une description des méthodes;

- des renseignements supplémentaires sur les processus écologiques d'importance et d'autres données non cartographiables ni visualisables sous forme de légendes;

- une bibliographie détaillée.

Compte tenu du problème à résoudre, il a été proposé que l'équipe fournisse à l'utilisateur plusieurs cartes d'interprétation dérivées des données de première main: cartes

- des possibilités récréatives;

- des régions dont les habitats fauniques et halieutiques doivent être protégés ou améliorés;

- des possibilités agricoles;

- des restrictions à l'exploitation forestière; et

- des affectations des utilisations du territoire.

SÉANCE PLÉNIÈRE

Kevin Van Tighem: Pourquoi pensez-vous que c'est à l'équipe chargée de l'inventaire écologique de produire des cartes dérivées qui définissent les usages les plus appropriés? Vous avez d'abord affirmé que l'équipe chargée de la classification écologique devait être distincte de l'aménagiste du territoire. Il me semble que ces interprétations devraient, dans une certaine mesure, être laissées à l'aménagiste après que l'équipe ait terminé la classification.

David Taylor: L'étude écologique du territoire, doit répondre aux besoins des utilisateurs. Je ne crois pas - et cela a été souligné lors de nos discussions - que nous prenions des décisions à la place de l'aménagiste. Nous lui fournissons des renseignements dits de première main ainsi qu'une série de cartes qui à notre avis seraient des plus utiles à ce dernier pour, dans l'immédiat, lui donner une idée de la façon d'utiliser les données.

Van Tighem: Mais en lui procurant ces cartes dérivées, ne le soulagez-vous pas de la nécessité de comprendre les cartes originales et de faire ses propres interprétations? Si on vous donne une série de cartes ou de recommandations, on vous épargne la nécessité de comprendre pourquoi elles sont recommandées, et comme la carte est entre vos mains, il vous est tout simplement facile de l'utiliser telle quelle. Il me semble que si les données sont présentées sur des cartes originales, de façon que les limites et les possibilités sont évidentes, alors les interprétations s'ensuivront.

Kurt Seel: Vous avez tous les deux raison, mais le hic est que les critères de base étaient que nous produisions ces cartes. Autrement, vous avez absolument raison. L'équipe chargée de la classification écologique devrait tout simplement faire un travail de déblayage, présenter les résultats bruts au planificateur ou à l'aménagiste et lui laisser faire son travail, mais dans le cas actuel, nous n'avons pas le choix. La question était tout simplement mal posée.

Harry Stelfox: Peut-être l'équipe a-t-elle mal lu la question? Ce scénario de problème est tiré directement du processus de planification de l'aménagement intégré qui est utilisé en Alberta par la Resource Evaluation Planning Division, et le planificateur des ressources naturelles dont il est question dans l'énoncé du problème est la personne qui est à la tête de l'équipe de planification. L'équipe de planification n'est pas une équipe qui fait du classement écologique du territoire. La distinction est importante. L'équipe de planification prend les renseignements découlant de l'inventaire des ressources et tient compte d'une foule d'autres considérations, compte tenu des demandes de l'utilisateur, des considérations socio-économiques, etc., et je crois qu'il y a confusion sur l'identité du planificateur des ressources naturelles. Dans chaque équipe de planification, il y aurait un spécialiste du poisson et de la faune qui fournirait les données pertinentes à l'équipe, et les préoccupations d'ordre halieutique et faunique toucheraient la foresterie et l'agriculture, etc. Peut-être y a-t-il confusion, mais je ne me chargerai pas de son entière responsabilité.

Paul Gray: Pourriez-vous expliquer comment vous avez décidé de ne pas utiliser de données sur les populations lors de la planification? Par le passé, un certain nombre de programmes de planification de l'utilisation des terres, partout au pays, ont établi des objectifs de populations et déterminé, par l'inventaire des territoires ou des programmes des possibilités, quelle était la superficie ou l'habitat nécessaire à ces populations. Ensuite, on s'est arrangé pour l'aménager ou le protéger d'une façon ou d'une autre. Selon votre présentation, la dynamique des populations n'intervient pas. Je suis conscient des difficultés de déterminer les populations, mais même si nous utilisions des indices relatifs de population cela nous aiderait à déterminer la superficie de territoire ou d'habitat nécessaire.

Geoff Holroyd: Pourquoi, selon moi, on n'utilise pas de données sur les populations, c'est qu'il s'agit d'une dérivation d'une application, si vous préférez, de la classification écologique du territoire après que cette dernière est réalisée. L'interprétation des possibilités d'hébergement, en relation avec les effectifs réels, découle du nombre d'animaux qui se trouvent sur le territoire et des renseignements sur l'habitat contenus dans la classification écologique. La classification écologique donne des renseignements de fond sur l'habitat, et l'utilisateur aménagiste de la faune ajoute les renseignements sur la population et en tire son schéma d'aménagement de la faune.

Joe Kuhn: Ce qui me frappe sans cesse, en ce qui concerne l'observation que le responsable de la faune fournira des renseignements sur l'usage des habitats dans ces unités du territoire, c'est que je ne crois pas qu'il pourra le faire par ce travail par équipe. Je crois que cela viendra avec le temps, en utilisant les unités du territoire mises au point par l'équipe interdisciplinaire, mais je ne crois pas que vous pourrez apporter les renseignements sur l'utilisation des habitats en moins d'un an ou deux, ce qui, je crois, serait le délai accordé pour le travail.

Taylor: Nous ne parlons pas de capture-recapture ou de quelque chose du genre. Nous parlons de recensement des fientes et de l'application d'autres méthodes raisonnablement simples, à quoi on ajoute ce qu'on sait déjà de la région pour obtenir une idée de l'utilisation des habitats.

Kuhn: Ne prenons que l'exemple des recensements des fientes. Vous avez une équipe qui explore une vaste région durant toute l'année, du printemps à l'automme. Les fientes ne seront pas les mêmes au cours de cette période et il en sera de même de tout autre indice de l'utilisation. Je ne crois pas que vous arriviez à quelque chose en un an: je crois que ceux qui s'y attendent sont des rêveurs.

Taylor: Geoff, votre expérience vous donne-t-elle une réponse à cela?

Holroyd: Je ne veux pas buter sur des détails, mais pour ce qui est du dénombrement des fientes, vous pouvez faire beaucoup de travail dans un été. Cela dépend de vos effectifs et de la mesure dans laquelle ils veulent faire les dénombrements. Si vous n'essayez pas d'évaluer les populations fauniques, alors vous mettez entre les mains du biologiste chargé de la faune un inventaire qui peut n'inclure aucun critère applicable à la faune. Joe travaille au Yukon, et d'après ce que je sais, les biologistes n'y apportent rien aux données d'inventaire; si lorsque vient le moment de les utiliser, il n'y a, par exemple, aucune information sur la couverture d'arbrisseaux dans leurs échantillons de végétation, ils ignoreront si cela est bon ou pas pour l'orignal parce qu'ils n'auront fait aucun échantillonnage eux-mêmes et n'auront pas participé à la définition des types de végétation ni d'aucune autre caractéristique des formes de terrain. Au début, le phénomène des avalanches a été ignoré à Banff et Jasper; c'est un phénomène de montagne

important pour la faune, mais temporaire aux yeux d'un botaniste ou d'un géomorphologue. Par conséquent, lorsque vous utilisez les données d'inventaire en tant que biologiste de la faune, vous vous fourrez le doigt dans l'oeil, parce que les avalanches sont un facteur important de modifications des habitats. Vous avez besoin du biologiste sur place et il doit travailler à l'échantillonnage, ce qu'il peut faire même si vous ne disposez que d'un an, car vous devez le tenter.

Taylor: Si nous ne disposons pas des méthodes convenables, nous devrions en mettre au point parce que tels sont les délais qui nous sont accordés. Nous ne pouvons pas nous permettre de passer cinq à six ans à leur établissement car les planificateurs, comme vous le dites, disposent de délais courts et il n'y a pas grand chose qu'on puisse y faire. Nous devons envisager des façons soit de modifier les méthodes actuelles, soit d'en créer de nouvelles et d'investir les efforts nécessaires là où ils le doivent.

Gray: Je puis peut-être préciser ma question, ce qui pourra clarifier la raison pour laquelle je l'ai posée. Vous avez énuméré à la fin de votre liste la fonction de planificateur des loisirs, et je suppose qu'un élément important des loisirs est la chasse. Vous devez accepter certains règlements, certains contingentements liés à la chasse et par conséquent, vous ne pouvez pas vous passer d'une certaine connaissance ou du moins de certains indices de la dynamique des populations des diverses espèces sauvages de la région. Passons maintenant à l'utilisation générale du territoire. Nous ne parlons pas que de chasse sportive, mais d'autres effets de l'utilisation des terres sur les populations fauniques, et c'est pourquoi j'ai posé la question et que je ne puis concevoir une équipe de planification qui ignore cet élément. L'autre question que j'allais poser porte sur la notion générale de coordinateur de l'équipe de planification et pourquoi ce poste ne devrait pas être occupé par un planificateur. En théorie, le planificateur possède une formation de généraliste et il peut traiter avec les divers groupes d'intérêt.

Taylor: Peut-être sommes-nous un peu provocateurs, mais le consensus dégagé d'expériences antérieures était que le planificateur ne devrait pas diriger l'équipe de classification écologique car la saisie et la synthèse des données de première main pourraient être délaissées en faveur de données destinées à appuyer des préjugés de planification.

Gray: Il pourrait s'agir d'un biologiste spécialiste de la faune qui a accédé à un poste de planificateur.

Taylor: Peut-être.

Christine Boyd: J'ai une observation à faire au sujet de ce que vous disiez sur l'habitat halieutique et c'est que nous nous occupons des pêches dans notre relevé écologique du territoire et nous avons constaté que, en utilisant le système RAB d'inventaire des cours d'eau et en repérant les interruptions de biefs, ils coïncident habituellement très étroitement avec les ruptures de pente des géologues.

Taylor: Oui, je crois que nous avons reconnu ce fait, mais il a été avancé qu'on ne pouvait pas corréler ces accidents à des formes spécifiques d'utilisation des habitats halieutiques. Malgré l'évidence de ces solutions de continuité, il y avait le sentiment qu'il était peut-être très difficile de corréler l'habitat halieutique à d'autres phénomènes qu'on cartographie en classification écologique du territoire. Vous avez probablement raison. Je crois que les relations existent, mais que nous ne les avons pas suffisamment mises au jour et que nous ne nous sommes pas posé les bonnes questions.

Boyd: Je souscris aussi à ce que disait Joe, que vous ne pouvez pas en une année conduire une étude détaillée de la faune, mais, en certaines régions comme le nord du Yukon, pourquoi voudriez-vous vous rendre sur place et faire une étude détaillée du caribou quand on sait que de telles études ont été réalisées au cours de la dernière décennie. Il doit y avoir un moyen de se servir de cet acquis aux fins des relevés écologiques du territoire et de recourir à un système normalisé pour les personnes qui recueillent des données pour d'autres raisons de sorte qu'on pourra s'en servir dans un système.

Taylor: Je n'ai rien à dire contre cela. Il me semble que si on recueille des renseignements de fond sur l'état actuel de la région à étudier, ces renseignements feront surface et serviront à déterminer des formes d'utilisation de l'habitat.

Boyd: Pensez-vous réellement qu'il est utile de s'asseoir et d'établir un schéma rationnel avant d'aller étudier les phénomènes sur place? D'après notre expérience, il faut au moins trois mois pour interpréter les photos, pour en tirer des renseignements géologiques. Est-ce que les pédologues, les botanistes, les géologues interprètent leur propre série

de photos aériennes ou se servent-ils d'une même série de photos?

Taylor: Le travail est supposé en être un d'équipe, comme nous avons essayé de le souligner. Le biologiste spécialiste de la faune doit y participer et dire aux autres membres de quel genre d'information il a besoin pour identifier et classer les habitats.

Brian Fuhr: J'aimerais partager votre point de vue parce que d'abord vous n'avez pas à aller sur place et à compter les fientes sur 2000 parcelles pour découvrir que les plaines inondables et la végétation au premier sère sont importantes pour l'orignal. On en sait déjà beaucoup sur l'utilisation des habitats. L'une des principales préoccupations est de maintenir l'habitat essentiel de la faune. Si on n'a pas réglé la question des possibilités des terres au-delà de ce qui existe actuellement, comment peut-on être sûr qu'un territoire suffisant subsistera pour répondre à vos besoins d'aménagement?

Taylor: Je ne suis pas sûr de bien vous comprendre.

Fuhr: Si vous ne vous occupez pas des possibilités, vous n'avez pas un bon produit, parce que tout est compliqué par la succession des communautés végétales. Une grande partie de votre forêt se trouvera à un sère tardif pour l'orignal et sera peu utilisée, mais quelques-unes de vos meilleures stations pourront être occultées par cela, et les régions qui renferment actuellement beaucoup d'orignaux peuvent avoir des possibilités inférieures à celles de vos meilleures stations. Une station récemment brûlée où la productivité est faible peut receler plus d'orignaux qu'une station qui a atteint le climax et où la productivité pour l'orignal est élevée.

Taylor: La question est, comme je l'ai dit plus tôt, que nous cartographions la végétation actuelle et que la végétation potentielle ou climacique est traitée sur une feuille annexe. La question se trouvera traitée dans le rapport, mais je doute qu'elle soit cartographiée, d'après l'impression que j'ai de la discussion. De plus, nous en savons beaucoup sur les étapes de la succession qui mènent au climax dans une région donnée et je crois que cette évolution peut être inférée de la végétation actuelle qui est cartographiée.

Fuhr: Si je vous comprends bien, vous voulez déterminer l'évolution de la végétation à partir du point où on se trouve plutôt que d'envisager une gamme complète de potentialités de la station, parce que vous voulez savoir si vous pensez que cette station possède beaucoup de potentiel pour l'orignal. Mais si au moment actuel on se trouve à un sère tardif et si vous brûlez la station, quel aspect aura la végétation et quelle sera son influence pour les différentes espèces fauniques? Vous avez besoin d'en savoir davantage que sa finalité, vous devez connaître son origine et l'importance de chacune de ces étapes pour la faune.

Taylor: Vous voulez donc dire que nous devons posséder des données sur les antécédents des stations.

Fuhr: Oui, ou d'inférer sa finalité ou ses possibilités.

Taylor: Vous voulez dire qu'on ne peut faire cette déduction à partir d'une carte de la végétation actuelle qui vous dira que la végétation de telle station est caractéristique d'un brûlé et que par conséquent vous savez pourquoi elle s'y trouve et quelle sera son évolutions probable.

Fuhr: Vous pouvez le faire, mais si vous n'avez aucun exemple de tous les sères pour ce paysage particulier, alors je ne vois pas comment vous pourriez le faire à partir de la carte.

Holroyd: J'ai une question à vous poser et peut-être puis-je répondre à la vôtre. Si vous avez deux stations identiques, l'une brûlée il y a dix ans et l'autre encore en forêt au stade du climax, parce que le sol y a un potentiel élevé, sont-elles colorées de la même façon ou indiquées de la même façon sur vos cartes?

Fuhr: Oui, je crois qu'il y a confusion ici entre les capacités actuelle et potentielle d'hébergement. Je parle ici de capacité potentielle.

Holroyd: D'après ce que je vois de votre interprétation du paysage, c'est qu'elle porte sur les possibilités mais ne tient pas compte de la sorte de calculs à faire pour déterminer ce qui s'y passe actuellement. En d'autres termes, combien d'hectares de brûlés trouve-t-on maintenant, combien d'orignaux s'y trouvent, combien veut-on en gérer et par conséquent, quelle superficie supplémentaire voulons-nous brûler? Si vos terrains brûlés et non brûlés, à possibilité élevée, sont colorés de la même teinte, alors vous ne pouvez tirer ce genre de renseignement. Ce que nous voulons, c'est de

connaître la végétation actuelle et, en supplément, du texte ou une carte supplémentaire qui nous diront que si nous brûlons cette forêt au stade du climax, alors nous aurons beaucoup d'habitats favorables à l'orignal. Ainsi, au moins, vous donnez à l'utilisateur la chance de voir dès maintenant que le peuplement est une pessière à maturité et qu'il n'est pas brûlé.

Fuhr: Peut-être disons-nous la même chose. Je ne crois pas qu'on puisse avoir l'un sans l'autre pour prendre une décision visant à améliorer l'habitat.

Holroyd: Vous avez d'abord besoin de connaître les conditions actuelles. Vous ne devriez pas procurer à l'utilisateur des données de seconde main et lui cacher les faits réels.

Fuhr: Selon l'objectif que vous vous êtes fixé, j'approuverai.

GROUPE DE DISCUSSION V

PROBLÈME

Un important consortium de sociétés privées d'exploitation de sources d'énergie propose de construire un gazoduc de 48 pouces de diamètre dans le nord du Yukon, pour relier un gazoduc existant dans la vallée du Mackenzie. Le groupe a proposé deux parcours mais préfère la soulution A (qui est moins coûteuse) à la solution B. Avant que sa demande de permis de construction puisse être approuvée, le groupe doit présenter une évaluation détaillée des incidences sur l'environnement et la société. La région visée est quasiment vierge et compte des réserves très riches de poissons et d'animaux sur lesquelles comptent beaucoup les autochtones pour leur subsistance.

POINTS À EXAMINER

1. Dans quelle mesure les données fournies sur l'inventaire permettent-elles la documentation des répercussions sur le poisson et les animaux et des possibilités d'atténuation liées aux parcours A et B? De plus, quelle utilité auront ces données pour l'examen des incidences sur l'économie des populations autochtones fondée sur la chasse, la pêche et le piégeage?

2. Quelles informations additionnelles faudrait-il obtenir pour réaliser ces évaluations?

3. L'échelle des cartes est-elle appropriée?

4. Compte tenu des problèmes qui se présentent, déterminer les points forts et les faiblesses des données.

5. Formuler une série de recommandations pour la préparation d'un ensemble de données idéales sur l'inventaire des habitats visés, que l'on pourrait utiliser pour résoudre les problèmes. Déterminer dans ces recommandations les échelles appropriées, les informations désirées et la présentation.

DONNÉES EXAMINÉES

1. Carte de la Série d'information sur l'utilisation des terres nordiques (à 1:250 000) pour la carte 117A du SNRC.

2. Cartes de l'inventaire des habitats fauniques (castor, orignal, caribou, oiseaux aquatiques etc.) du nord du Yukon.

3. Carte du relevé écologique du territoire du Nord pour le nord du Yukon.

MEMBRES DU GROUPE DE DISCUSSION

Gary Ironside (président), Christine Boyd (secrétaire), Ed Oswald, Les Gyug, Kevin McCormick, Linda Cole, Judy Smith et Jim Hancock.

RAPPORT ET RECOMMANDATIONS

(corrigés et révisés par Christine Boyd et Gary Ironside)

Examen

Le groupe conclut que ni la carte de la Série d'information sur l'utilisation des terres nordiques pour la carte 117A du SNRC, ni les cartes de l'inventaire des habitats fauniques, ni la carte du relevé écologique du territoire du Nord ne seraient utiles à une évaluation des incidences environnementales des deux parcours proposés pour le gazoduc dans le nord du Yukon, pour les raisons suivantes:

1. la carte de la Série d'information sur l'utilisation des terres nordiques est beaucoup trop générale; il s'agit avant tout d'une carte topographique à laquelle on a ajouté quelques données fauniques sur la source et la qualité desquelles les membres du groupe ont émis des réserves; il n'y a aucune indication sur les parties qui n'ont pas fait l'objet d'un relevé faunique, de sorte que l'on ne sait pas si les zones pour lesquelles aucune donnée sur la faune n'est fournie sont dépourvues de faune ou si l'on ne dispose pas d'informations à ce sujet;

2. les cartes de l'inventaire des habitats fauniques sont à une échelle trop petite, et les informations qu'elles comportent sont beaucoup trop générales pour être utiles à une évaluation des incidences environnementales;

3. la carte du relevé écologique du territoire du Nord n'a pas été considérée utile; elle fournit des informations appropriées sur le relief mais seulement des renseignements très généraux sur la végétation, quelques données sur les lacs et aucune sur la faune terrestre ou aquatique.

Pour une étude d'impacts d'un méga projet comme la construction d'un gazoduc, on considère qu'une échelle de 1:250 000 est appropriée.

Recommandations

a) L'outil le plus utile à une évaluation des incidences d'un méga projet serait une carte de la classification écologique du territoire à 1:250 000, comportant des informations sur:

1. le relief et les sols;

2. la végétation actuelle (et potentielle, dans la mesure du possible);

3. les utilisations actuelles et historiques connues de la faune (ne pas employer de données sur le potentiel faunique des terres);

4. les considérations socio-économiques comme les territoires de piégeage, les zones enregistrées de pourvoyeurs pour gros gibier et les espèces rares ou menacées d'extinction; ces dernières données ne devraient pas être ponctuelles mais couvrir un vaste territoire; au besoin, on indiquera un organisme comme contact auprès duquel on pourra obtenir des renseignements plus précis.

b) Les données apparaissant sur l'endroit de la carte devraient être sous forme matricielle informatisée. Les cartes et les matrices devraient être introduites dans un ordinateur pour permettre la mise à jour, à mesure que de nouvelles données arriveront.

c) Un texte exposant les méthodologies employées et définissant les termes utilisés devrait être rédigé pour la carte. On procéderait de la sorte pour toutes les autres cartes. Il faudrait également décrire les communautés végétales, les différents sols et les déplacements des animaux.

d) La carte devrait comporter une bibliographie des sources d'informations consultées et à consulter pour l'obtention de renseignements additionnels (par ex., comme les cartes de la Série d'information sur l'utilisation des terres nordiques, publiées récemment, qui portent une bibliographie au verso).

SÉANCE PLÉNIÈRE

Paul Gray: Une fois le parcours du gazoduc déterminé, ne croyez-vous pas qu'il serait souhaitable d'accroître à 1:50 000 l'échelle des cartes afin de déterminer les zones de préoccupations possibles, par exemple, concernant la mise en place de régions-tampons pour les rapaces nicheurs?

Christine Boyd: Pour choisir entre deux trajets proposés, les informations fournies sur une carte à une échelle de 1:250 000 sont suffisantes. Toutefois, après avoir recommandé une voie, il faudrait produire une carte d'alignement définitive en se fondant sur des informations beaucoup plus détaillées qui sont généralement présentées sur des cartes dont l'échelle est beaucoup plus grande.

Paul Gray: Je suis d'accord avec les observations au sujet de l'intégration et de la méthodologie normale. Dans les T.N.-O., il arrive souvent que nous ne puissions déterminer la qualité des études, faute de connaître la méthodologie employée pour le relevé.

Joe Kuhn: En ce qui concerne vos recommandations sur les utilisations fauniques connues et le potentiel faunique des terres, ne serait-il pas bon et même utile de donner une cote élevée à une partie qui semble avoir une vocation particulière pour une espèce donnée, selon les besoins de l'espèce en question, même si cette espèce n'a pas été observée dans cette zone au cours des dernières années?

Christine Boyd: Si une espèce est absente d'une zone qui semble avoir des possibilités élevées pour cette espèce en particulier, c'est peut-être que l'on n'en connaît pas suffisamment sur les besoins de cette dernière en matière d'habitats et que, en réalité, la zone en question ne possède pas de potentiel élevé.

Kevin Van Tighem: Je crois que, dans ce cas, le mot potentiel n'a pas le même sens pour tout le monde. S'il s'agit d'une valeur prévue qui n'est fondée sur aucun fait concret, je crois qu'elle ne devrait pas être utilisée. Par exemple, si aucun chasseur, trappeur ou biologiste n'a observé de caribou dans la zone en question, même si cette dernière semble être un bon habitat pour cette espèce, je n'oserais pas dire qu'elle présente de grandes possibilités pour cette dernière. Vous allez plus loin que ne vous le permettent les données que vous possédez.

Robyn Usher: Je me demande si, à une échelle de 1:250 000, il est possible de cartographier

efficacement les espèces rares ou menacées d'extinction.

Christine Boyd: Oui. Un symbole dans un polygone pourrait indiquer qu'une espèce rare ou menacée d'extinction a été observée dans les limites de la zone. Pour une planification plus détaillée, afin d'obtenir des données plus précises sur les lieux, vous pourriez ensuite communiquer avec les services de la faune du Yukon ou des T.N.-O. ou encore avec le SCFaune.

Kurt Seel: Cette question est délicate, étant donné qu'elle touche à des informations privilégiées. Lorsqu'une zone donnée sert d'habitat à des faucons pèlerins ou à d'autres espèces que nous voulons protéger pour diverses raisons, il arrive souvent que l'on ne désire pas publier cette information. Or si, au niveau de la classification écologique du territoire, le biologiste commence à cacher des informations, c'est toute l'équipe qui est frustrée. Comment les planificateurs peuvent-ils aider à protéger ce dont ils ne sont pas au courant?

Christine Boyd: Sachant que le polygone abrite des faucons, le planificateur peut consulter les biologistes afin de localiser les habitats; cependant, ces informations ne peuvent être divulguées à des personnes dont les intentions ne sont pas sûres.

Kurt Seel: Dans l'examen de grandes superficies, il devient très fastidieux pour le planificateur ou le gestionnaire de téléphoner constamment à un biologiste pour obtenir des détails qui ne sont indiqués nulle part.

Christine Boyd: Nous ne voulons pas priver les planificateurs ou les gestionnaires de ces renseignements; nous voulons simplement en restreindre l'accessibilité par le public.

Geoff Halroyd: À Parcs Canada, plutôt que de donner aux planificateurs des cartes à quadrillage UTM indiquant les nids d'aigles, nous leur fournissons des cartes portant des cercles. Qui plus est, certains nids d'aigles sur quadrillage UTM ne sont même pas indiqués parce que nous n'avons pas confiance en l'analyse informatisée.

Kurt Seel: Il n'empêche que des barrières s'érigent; j'en ai déjà trop vues et cela me choque. Quant au potentiel, on en a déjà beaucoup parlé. Du point de vue du planificateur, il semble que les équipes de la CET veulent nous donner des interprétations plutôt que des faits. Une carte de potentiel n'est rien d'autre qu'une interprétation.

Christine Boyd: Une carte de potentiel n'est pas nécessairement une interprétation. Cependant, compte tenu des connaissances que nous possédons sur les besoins en matière d'habitats de nombreuses espèces, je crois que les cartes de potentiel sont des interprétations.

GROUPE DE DISCUSSION VI

PROBLÈME

Le coordonnateur des questions écologiques d'une petite firme-conseil dont les services ont été retenus par une importante compagnie d'exploitation pétrolière et gazière, doit localiser le tracé d'un gazoduc de 12 po de diamètre qui entraînera le moins de répercussions néfastes pour l'environnement. Le gazoduc partira d'un point collecteur situé exactement au centre du canton 46, région 16, et aboutira à une usine à gaz située dans le coin sud-est du canton 46, région 14. Une emprise de 60 pi de largeur devra être dégagée.

Les principales considérations d'ordre écologique portent entre autres sur:

1. le choix du moment de la construction, afin de réduire les répercussions sur le poisson et la faune.

2. le choix du tracé de façon à éviter de perturber des habitats de qualité et les espèces vulnérables.

3. l'amélioration de l'habitat lorsque c'est possible.

POINTS À EXAMINER

1. Dans quelle mesure les inventaires (dont les résultats sont fournis) permettent-ils de déterminer les valeurs fauniques et halieutiques ainsi que les répercussions possibles de façon à faciliter le choix du tracé?

2. Quels sont les renseignements supplémentaires dont on aura besoin pour ces déterminations?

3. L'échelle cartographique des inventaires convient-elle?

4. Connaissant ces problèmes, identifier les principaux points forts et points faibles des inventaires.

5. Préparer une série de recommandations pour la préparation d'un inventaire idéal des habitats qui pourra servir à résoudre le problème. Préciser le ou les échelles cartographiques convenables, la teneur en renseignements et la présentation des données.

DONNÉES EXAMINÉES

(1) Carte des régions vitales pour la faune en Alberta et cartes de la collection Inventaire des terres du Canada pour les ongulés, la sauvagine et la pêche.

(2) Carte de la collection Classification écologique du territoire de la région de Brazeau-Pembina, le rapport sur la même région ainsi que des évaluations de la vulnérabilité du terrain.

MEMBRES DU GROUPE DE DISCUSSION

R. Usher, A. Krause, D. Clavet, L. Lewis, O. Nieman, B. Delaney et P. Nuttall.

RAPPORT ET RECOMMANDATIONS

édités par Art Krause et Robyn Usher

Pour établir les recommandations à faire à la société pétrolière au sujet du tracé, les documents de base (cartes à 1/250 000 des possibilités pour les ongulés et la sauvagine) ne nous ont pas paru convenir le moindrement. Le second dossier fourni contenait des renseignements fondamentaux sur la végétation, la pédologie et l'hydrographie de toute la région, à l'échelle de 1/100 000, ce qui est mieux que l'échelle initiale à 1/250 000, mais, selon le consensus du groupe, néanmoins inapproprié pour distinguer le tracé le plus convenable ou le moins perturbateur pour l'environnement. Nous avons supposé que le proposeur nous fournirait à nous, les ingénieurs-conseils, les moyens minimaux ainsi que les conditions techniques permettant de nous rendre du point A au point B.

Même si les renseignements fournis convenaient, l'échelle ne constituait pas moins une cause de difficulté. Dans l'ensemble, on a pensé que des sources secondaires d'information, complétées par des déterminations nécessaires sur place de l'utilisation des habitats locaux, étaient essentielles au choix du meilleur tracé. Pour être plus précis, on considérait comme tels, pour l'évaluation des caractéristiques physiques des régions à étudier, les

renseignements d'ordre physiographique, pédologique, hydrologique, hydrogéologique et climatique. La pente, l'exposition et l'épaisseur de la couverture nivale étaient considérées comme spécialement importantes.

Nous avons supposé que nous proposerions aux ingénieurs de la compagnie un certain nombre de tracés précis et nous avons pensé que le genre de renseignements nécessaires devait être à l'échelle de 1/10 000. C'était, pensions-nous, nécessaire afin de distinguer les répercussions relatives des divers tracés. Il en était de même pour les aspects biologiques et anthropiques que nous avons généralement réunis sous les rubriques suivantes: utilisation des terres, foresterie, exploitation minière, formes de propriété foncière, etc. Comme certains groupes l'ont aussi mentionné dans leurs présentations, l'une des principales caractéristiques des données à recueillir était que celles-ci devaient être à l'échelle de 1/10 000 et être compatibles avec cette échelle puis emmagasinées dans une base informatisée à laquelle on pourrait accéder et qu'on pourrait réorganiser et manipuler à mesure que des faits nouveaux ou des conditions nouvelles se présenteraient, ceci pour apporter des retouches au projet, soit pour ce qui est du choix du moment des travaux, compte tenu des régions fauniques clés, soit pour ce qui est de l'espèce ou des espèces pour lesquelles ces régions étaient vitales ou importantes. Ceci n'était pas évident à l'échelle cartographique ou aux annexes dont nous disposions pour ces cartes.

À un autre moment, comme cela vient d'être évoqué par M. Stelfox, nous avons discuté du bien-fondé de nos besoins concernant l'échelle des cartes. En général, d'après nous, l'exposé des possibilités ne convenait pas à l'évaluation des divers tracés. Ce qu'il nous fallait, c'était de pousser la cartographie jusqu'à un niveau utilitaire ou convenable permettant de distinguer l'étendue ou l'intensité de l'utilisation des régions au-delà de celles qui étaient définies comme vitales. Je ne sais pas si cela nous aide ou nous complique la tâche, mais nous devinions une gradation entre l'échelle des possibilités ou de reconnaissance et celle qui était plus près de la vérification de terrain.

Nous nous proposons d'identifier les contraintes à partir de ces éléments qui peuvent être cartographiés selon des caractéristiques physiques, à l'échelle de 1/10 000. Seulement pour exemple, citons la topographie, les formations de surface, la géomorphologie, la pente, l'exposition. Pour ce qui est de l'habitat, nous pourrions cartographier (toujours à 1/10 000) l'utilisation ou les disponibilités de peuplements de qualité suffisamment élevée ou tout signe de l'utilisation saisonnière d'une région par une espèce. D'après nous, toutefois, la façon de faire la plus utile était de mémoriser ces renseignements sous forme numérique dans une base de données informatisée. Ainsi, ce que nous appelons élément pourrait être classé et réorganisé d e diverses façons, selon divers critères.

Ce que nous voulons ensuite suggérer, c'est la quatrième étape, à laquelle nous obtenons des cartes distinctes pour les trois facteurs et une quatrième carte qui délimite, par synthèse, intégration ou superposition au moyen d'une méthode automatisée, ce qui pourrait être considéré comme des zones de contrainte ou "points chauds". Selon l'époque de la construction, la durée des travaux, etc., ces "points chauds" pourraient varier en fonction de certains des autres facteurs et nous aurions alors des cartes des zones de contrainte tout à fait indépendantes de la base de données. D'après nous, une telle méthode nous donnerait beaucoup de latitude pour examiner et pondérer les données de diverse façon. Dans ce scénario où nous jouons le rôle de firme-conseil, nous avons pensé que notre responsabilité professionnelle se limitait à détailler les contraites, au moyen d'une carte des "points chauds"; à une étape spécifique de la sélection du tracé, nous travaillerions en consultation avec la compagnie, au moyen d'un dialogue ininterrompu, afin d'établir un ensemble préliminaire de "points chauds". Ainsi, nous pourrions déterminer et exposer un détail les répercussions auquelles on pourrait remédier et celles auxquelles on ne pourrait pas remédier.

Dans la mesure où il nous était demandé de déterminer le tracé le moins perturbateur, nous avons pensé qu'il conviendrait davantage de le faire indirectement, c'est-à-dire de rassembler les données nécessaires puis, par itération, de concert avec la compagnie, d'établir le tracé approprié.

SÉANCE PLÉNIÈRE

Kevin Van Tighem: Est-ce que la cartographie se ferait par polygones, mappons ou points?

Krause: Par mappons.

Van Tighem: Auriez-vous utilisé les mêmes pour décrire les caractéristiques physiques et celles de l'habitat ou auraient-ils été plus ou moins indépendants?

Olaf Nieman: En réalité, les polygones de

chaque carte seront intégrés au moyen d'un modèle, et une nouvelle représentation sera créée grâce à un modèle informatique. La carte que vous utilisez ou les cartes que vous produisez différeront beaucoup des caractéristiques physiques ou des caractéristiques de l'habitat.

Van Tighem: Je m'interrogeais parce que j'ai constaté que, dans un grand nombre de cas, les caractéristiques physiques et l'habitat vont probablement se superposer et que je ne sais pas comment vous stratifieriez votre échantillonnage, mais il me semble que vous auriez à déterminer votre habitat à partir de quelque chose qui est cartographiable, qui aurait à faire avec les caractéristiques physiques. Je me demandais pourquoi il n'y aurait pas un chemin plus court pour construire votre carte des caractéristiques physiques, puis coter chaque unité physique pour sa valeur comme habitat, ce qui économiserait une étape supplémentaire. En effet, je ne vois pas comment vous avez fait autrement.

Nieman: On peut présumer que vos cartes des habitats seraient obtenues à partir des caractéristiques physiques et seraient mémorisées séparément après avoir été produites.

Van Tighem: Ainsi, il y aurait des limites communes mais pas toutes les mêmes valeurs.

Nieman: Exact.

Krause: Je crois qu'une raison de la distinction entre limites d'habitat et limites physiques était que nous nous inquiétions des implications plus générales de logistique ou de construction et nous avons pu avoir légèrement outrepassé notre mandat concernant les habitats fauniques. Nous avons perçu des problèmes d'érosion, de pente et d'exposition comme étant tout simplement d'ordre physique, sans relation avec les détails particuliers d'habitat dont vous avez posé la question, ce qui fait qu'encore une fois, nous essayons de percevoir toutes les facettes. Nous avons eu quelques difficultés à nous limiter aux aspects de ce type de travaux touchant les habitats biologiques. Il semblait plus réaliste d'appliquer ce système à un agencement de facteurs humains, floristiques, physiographiques qui influenceraient sur le choix du tracé le moins perturbateur.

Joe Kuhn: De votre évaluation des unités d'habitat, je n'ai pas compris si vous les évaluiez en tant que "points chauds" actuels ou en tant que potentiels d'habitats.

Krause: Je crois que nous visions plus la présence ou l'absence actuelle d'espèces ou la présence de certains types d'habitats où il y a eu des signes qu'ils ont été utilisés par diverses espèces. En ce sens donc, nous divergions de l'évaluation théorique des possibilités qui sont à la base de l'inventaire des terres du Canada. Nous recherchions plus des renseignements vérifiés sur place pour déterminer plus de problèmes locaux. Nous pensions que ces problèmes que visait le travail exigeaient un examen plus attentif de l'utilisation des habitats ou des signes de leur utilisation.

Kuhn: Une seconde question, que je crois reliée à la première et qui concerne votre évaluation des répercussions d'où il s'ensuit que le choix du tracé ressemble à celui de solutions possibles: corréliez-vous la valeur de ces unités d'habitat à la disponibilité des ressources en ce sens que la base de données la plus grande, la carte régionale à 1/100 000 que vous avez consultée, était ce facteur considéré?

Krause: Je crois que c'était implicite, si cela n'a pas été dit, que la carte à 1/100 000 était utile au premier découpage, pour obtenir un aperçu des espèces qui pourraient être d'intérêt et de ce que nous aurions à étudier sur place, plus intensivement. Dans le cas des cartes des régions clés de l'Alberta, il s'agissait de l'orignal et du wapiti comme se trouvant à peu près dans les environs. Ceci nous a semblé comme un indicateur clé d'une utilisation potentielle de la région proposée entre les points A et B. Par conséquent, lorsque nous avons examiné l'utilisation d'autres zones, la carte à 1/100 000 servait à déterminer ce qui nécessitait un examen plus détaillé, plus rapproché. Par exemple, il y avait des zones de nidification d'aigles pêcheurs et de grands hérons sur la carte générale. Mais à cause de leur nature très ponctuelle, cela nous a incités à examiner l'utilisation des cours d'eau par les espèces, etc., dans la zone générale entourant les zones de nidification.

Kuhn: La seule chose à laquelle je voulais en venir par ma question était de situer les répercussions dans leur juste perspective.

Krause: Oui, c'était notre intention. Ce n'est pas montré visuellement, mais nous nous sommes astreints plusieurs fois à visualiser le produit final. Nous avons conclu que des symboles de couleur ou des formes permettant d'identifier l'habitat et les types de répercussions pourraient être interprétés comme des répercussions à court terme liées à la réalisation du projet et comme des répercussions à long terme liées à la

présence de l'emprise dégagée de 60 pi de largeur. En ce sens, on pourrait coter de façon qualitative les questions en ordre d'importance et en arriver à des "indices d'importance". Je crois que nous avons constaté à un point donné que l'établissement d'un "indice d'importance" est une question de dialogue. À un certain moment, des compromis devront être faits, mais nous ne devrions pas nous enfermer dans une position où ils seront prématurés. Ils pourraient être faits en discutant avec les ingénieurs et en découvrant quel est le tracé raisonnable, en mettant dans la balance les répercussions à court terme d'une part et les répercussions à long terme d'autre part.

Lee Lewis: Comme à-coté, il serait très naïf de notre part de placer une contrainte d'échelle sur nos préoccupations. Les êtres vivants ne reconnaissent pas les limites politiques. Ils sont intégrés à un très haut niveau. Si nous prenons les choses et les découpons de façon non naturelle, il subsiste des processus qui restent très fortement reliés entre eux. Nous devons connaître tous les aspects du projet, gérer ou contrôler les effets de l'installation. Donc, discuter à savoir si nous avons examiné les possibilités, les utilisations ou l'à-propos est de discuter contre nous-mêmes. Nous devrions examiner tout ce qui constitue une contrainte puis le classer de sorte qu'au lieu d'utiliser notre matière grise, laquelle a fait ses preuves, ne me prêtez pas de mauvaises intentions (elle sert depuis que l'homme est homme), nous pouvons utiliser certains outils, si nous sommes futés. L'un d'eux est le chargement des données assisté par ordinateur. Il devrait être polyvalent, se plier à notre volonté et c'est ce que nous cherchons à construire. Quelque chose qui en toute probabilité permettrait d'obtenir un modèle et une estimation des répercussions, non pas un tableau intégral, quelque chose de parfait, mais plutôt quelque chose que nous pouvons travailler, renforcer, vérifier et grâce à quoi on peut en venir à l'aménagement au vrai sens du terme, c'est-à-dire non pas la seule utilisation des zones floristiques et fauniques extrêmement importantes, mais aussi de tous les différents aspects des interactions anthropiques et non anthropiques sur la terre et ses possibilités. C'est impossible si vous faites appel à une table ronde. Vous ne perdez rien des données initiales, qui ne sont aussi valables que les gens qui les obtiennent, en construisant des visualisations qui peuvent aider la mémoire et le raisonnement. C'est pourquoi nous faisons ce travail de définition. C'est un début et il est à souhaiter que c'est un moyen d'en arriver à une intégration réelle plutôt qu'à une simple superposition mécanisée.

Harry Stelfox: Deux choses. L'une probablement juste une question de clarification. Jusqu'à maintenant, aucune mention de la végétation. À moins que ce ne soit un élément de votre aspect d'utilisation des terres. Je me demandais si vous avez déterminé ou non le besoin de cartographier la végétation afin de faciliter l'évaluation des habitats à l'échelle de 1/10 000. Est-elle réellement cartographiée et présentée à cette échelle?

Krause: Oui.

Stelfox: Bien. Ceci m'amène à ma deuxième question. Avez-vous perçu le besoin d'intégrer la cartographie de la végétation à la cartographie physique et avez-vous tenté de déterminer si la classification biophysique ou écologique intégrée des terres était nécessaire ou utile à la résolution du problème?

Krause: Pour ce qui est de l'échelle, je n'ai pas pensé que la classification écologique du territoire convenait aux unités que nous pensions devoir cartographier afin de faire les distinctions appropriées. Maintenant, je crois que nous avons en quelque sorte évité de nous pencher sur la classification écologique du territoire au début parce que d'après nous, l'échelle n'était pas appropriée.

Van Tighem: Je contesterais cette affirmation parce que, d'après moi, en classification écologique du territoire, l'écosite est à l'échelle de 1/10 000 à 1/50 000. D'après ce que je crois comprendre de l'écosite, du moins d'après mon expérience personnelle, c'est qu'il serait très approprié pour cette sorte de discrimination que vous recherchez pour votre carte n° 1, parce que vous ne recherchez pas seulement une unité terrestre ou du paysage mais vous examinez comment elle est subdivisée selon la végétation, du moins à cette échelle à laquelle vous travailleriez, et je crois que vous obtiendriez une résolution encore plus fine que si vous vous penchiez uniquement sur les formes de terrain. De plus, cette résolution fine vous aiderait à évaluer l'habitat que j'utilise pour votre deuxième carte.

Krause: Très bien, je crois que je vais accepter ce conseil.

Lewis: Il y a plusieurs façons de planter un chou, et c'est des plus évident que lorsque

vous commencez à produire ces documents (nous parlons de rassembler une carte finale des principales contraintes, qu'elles soient le fait de la construction ou d'origine biologique ou anthropique). Mais venons-en aux jugements, parce qu'il y en aura de posés et que c'est ainsi que les cotes seront établies. Donnons des mesures précises, des rapports valides, essayons de les manipuler plutôt que de considérer qu'ils sont trop difficiles parce que ce sera l'esprit humain, seul ou assisté par ordinateur, qui en viendra à décider du tracé; les axes de transport seront établis d'après tous ces aspects et nous allons devoir poser des jugements. Donc, lorsque vous faites des comparaisons puis votre deuxième découpage puis votre troisième, c'est là que vous obtenez cette carte finale, au niveau auquel vous avez ordonnancé les choses, d'après la gravité des contraintes, et toutes doivent être considérées.

Van Tighem: Je ne comprends pas tout à fait. Êtes-vous d'accord ou non?

Lewis: Je suis d'accord avec vous, mais tout ce que je dis c'est qu'il n'y a aucun moyen établi de procéder. J'aimerais qu'il y ait une solution simple au problème. Ce n'est pas complètement impossible, parce que j'ai moi-même construit des cartes de ce type et elles sont tout à fait dans le domaine du possible. Inévitablement, il subsiste une question de subjectivité. Quiconque pense que vous serez totalement objectif fait preuve de naïveté parce que nous ignorons quelles sont les questions pertinentes à poser. Nous ne les posons pas toutes. Nous pouvons nous perdre dans l'abstraction, mais ce qui est important en définitive, c'est de déterminer les contraintes, quelles qu'elles soient. Nous devons en tenir compte lors de la prise de décision et, à ce titre, la végétation peut avoir une importance très forte. Elle peut être d'importance modérée ou faible sur une superficie donnée et si vous avez affaire à une vaste superficie, vous avez à tenir compte des coûts. Si vos déterminations arrivent à suffisamment de "points chauds", vous pouvez les ramener à un niveau de définition, aboutir à une visualisation concrète au niveau du détail. Si vous négligez une zone de répercussions, vous essayez de faire mieux la fois suivante, et vous aurez à l'atténuer et à refaire ce modèle particulier. Personne ne construira jamais de modèle qui répondra à toutes les questions. J'aimerais voir cette notion explicitée parce que je crois que c'est l'aboutissement naturel du classement écologique du territoire, et je crois que c'est une excellente façon de faire.

Krause: J'aimerais vous poser une question: disiez-vous que les données au niveau de l'écosite existent pour cette région ou existent en tant que méthode par laquelle nous pourrions recueillir et organiser les données? Votre proposition et la nôtre sont-elles mutuellement exclusives ou ne faites-vous que proposer un perfectionnement de notre propre proposition?

Van Tighem: Ce que je proposais était une explicitation de votre proposition. Je ne vois pas pourquoi la carte n° 1 devrait être une carte des caractéristiques physiques. Si c'est la carte à partir de laquelle on entreprend son travail, alors aussi bien commencer par le système de classification écologique du territoire et en intégrer les informations.

Krause: C'était ce vers quoi nous nous dirigions par l'obtention d'une carte avec les éléments de laquelle nous pourrions jouer. Nous pourrions les combiner, je ne veux pas dire simplement, de façon interne, au plan des caractéristiques physiques, mais aussi, avec autant de facilité, pour ce qui est des facteurs de l'habitat ou de l'utilisation des terres, ce qui nous procurerait un système par lequel vous pourriez en effet avoir une carte des écosites ou une classification écologique du territoire.

Lewis: Si nous possédons le reste de l'information, assurément allons-nous nous en servir, mais postérieurement au détail ou à l'échelle dont nous avons besoin pour une contrainte donnée qui doit être très détaillée pour être comprise. Vous savez que je me servirai de votre information qui est exacte d'où qu'elle provienne. Je ne suis pas inféodé à une discipline particulière. Je ne me soucie pas de ce que vous alliez de A à B ou de B à A, peu importe. Chaque problème suscité possède ses propres anomalies localisées et ses propres ordres d'événement. Lorsque vous travaillez à les résoudre, vous devenez un meilleur planificateur en les prévoyant.

Stelfox: Il est une chose à laquelle sont aveugles beaucoup de tenants de la classification écologique du territoire, c'est que leur art (effectivement c'en est un) puisse être remplacé par quelque superposition mécanique d'une variété de découpages du paysage, obtenus par synthèse informatique des différents types de données sur les sols, la topographie, la végétation, etc., et qui pourrait avoir été créée d'une façon peut-être quelque peu indépendante, en remplacement du type de cartographie des milieux naturels qui

obéissent à la classification écologique du territoire. Je ne sais pas vraiment si nous voulons en discuter trop longuement, mais j'ai l'impression que vous laissez en fait entendre qu'un ordinateur pourrait être une solution de rechange pour l'obtention d'une carte biophysique intégrée.

Lewis: C'est un outil. Il n'est aussi valable que le sont les données de départ. Assurément, il ne diminue pas le besoin de scientifiques qui font du bon travail. Il ne fait que faciliter le travail, le rendre moins fastidieux et, pour mémoire, nous soulage de l'inquiétude que nous pouvons ressentir de ne pas être capable d'intégrer ces systèmes sans erreur systématique. Le résultat ne sera pas de la bouillie pour les chats. Le jugement y a encore sa place. Vous avez encore à séparer ce qui est secondaire et à le discerner parmi vos groupes. Le bon sens est encore nécessaire, beaucoup de discernement et de compétence.

Stelfox: Je ne crois pas vouloir poursuivre sur cette voie maintenant.

Kuhn: Pour commencer, j'ai observé une difficulté que la discussion a mise en évidence, et, apparemment, il s'agit de distinguer entre l'évaluation biophysique du territoire et l'évaluation de la valeur accordée à l'utilisation des terres. Un bon exemple serait ce que je me souviens s'être produit en Colombie-Britannique. Lorsque le comité de l'utilisation des terres a élaboré des lignes directrices, le travail biophysique constituait une science écologique assez autonome, un produit d'interprétation et de travail interdisciplinaire. En d'autres termes, dans ce cas, je crois que nous avons à intégrer la cartographie en écosites. Nos scientifiques se sont entendus sur ces unités et de là nous pouvons passer au domaine socio-économique où on attribue des valeurs et où on utilise la faune comme exemple. Paul Gray a donné un excellent exemple ce à quoi on s'est continuellement heurté dans les Territoires du Nord-Ouest. Les biologistes de la faune, les biologistes de l'aménagement peuvent évaluer certaines unités du terrain différemment, selon leur valeur pour la faune, des aborigènes qui subsistent ou exploitent ces ressources, à cause de considérations de proximité, de culture, etc. Je pense donc qu'il est très important de ne pas mêler les questions socio- économiques et biophysiques. Je crois qu'elles doivent être intégrées. Cependant, lorsque nous faisons une évaluation biophysique, nous devons le faire à un niveau puis nous devons réunir les sociologues sur place et mettre au point le "calque de superposition socio-économique" qui sera couché sur la base biophysique.

Doug Meeking: J'aimerais faire quelques observations sur l'ensemble du processus. Je crois que vous avez choisi la bonne façon de faire pour le travail qui vous était confié, compte tenu de l'ampleur du projet. J'aimerais cependant ajouter une chose et je crois qu'elle s'articule sur la dernière observation de M. Stelfox concernant l'informatisation. Je crois que vous pourriez produire une carte synthétique des "points chauds" au moyen d'une simple série de calques de superposition, transparents, couchés sur votre fond de carte, que vous feriez le même travail que pourrait faire votre ordinateur et que pour un projet de localisation d'un tracé d'un gazoduc de 26 milles de longueur, la cartographie informatisée serait d'après moi et de toute façon forcer la note.

Lorsque vous vous trouvez dans une situation beaucoup plus complexe que celle qu'on connaît sur le versant oriental des avant-monts des Rocheuses, le sud de l'Ontario où vous avez un nombre indéfini de situations complexes, de restrictions quant à la planification de l'utilisation des terres ou Dieu sait quoi en étant un exemple, je serais alors en faveur de l'utilisation d'un ordinateur pour absorber la masse de données beaucoup mieux qu'un petit groupe de personnes; mais dans une situation très simple comme celle à laquelle vous avez affaire, je pencherais pour l'utilisation de calques obtenus manuellement, pour réaliser le travail de façon tout à fait convenable. Ceci n'est qu'une opinion personnelle. Autre chose sur l'utilisation de l'échelle à 1/10 000 pour la sélection du tracé, cherchiez-vous à obtenir un tracé définitif ou un corridor de 0,5 km ou de 100 m de largeur?

Krause: On nous a demandé de déterminer le tracé d'une emprise de 60 pieds de large et nous avons présumé que l'étape subséquente était de centrer le gazoduc, travail qui évidemment demanderait plus de détails.

Meeking: Ordinairement, pour un gazoduc comme celui-là, vous auriez une emprise de 60 pieds de largeur, bien délimitée je crois, et 30 pieds de part et d'autre de la médiane. En réalité, ce sont les ingénieurs qui s'occuperont du positionnement. C'est eux qui dessineront la médiane, aucun doute à ce sujet. Encore une fois, je crois que l'échelle à 1/10 000 devrait vous permettre de bien délimiter un corridor, disons de 100 m, à l'intérieur duquel les ingénieurs

pourraient eux-mêmes délimiter leur emprise de 60 pieds de largeur qu'ils veulent y dégager. Mais, dans l'ensemble, je crois que vous vous êtes très bien acquittés de votre travail.

Lewis: Je crois que ma première préoccupation est que vous n'avez jamais un gazoduc flottant dans les airs. Si j'étais un vrai planificateur, l'usine à gaz, existante ou probable, je la ferais améliorer, de sorte qu'au lieu de recueillir les données importantes dans une atmosphère raréfiée, pourquoi ne pas les prendre comme elles sont et un jour nous disposerons des critères définis de telle sorte qu'elles se trouveront sur un simple calque de superposition. Je souhaite que cette éventualité ne soit pas trop lointaine.

Meeking: Je crois encore une fois que chaque projet est un cas d'espèce. Si vous êtes dans une région plus rapprochée de l'activité où l'utilisation des terres est beaucoup plus complexe, alors j'y souscris sans réserve. Mais dans une situation à laquelle vous vous heurtez, fondamentalement une zone d'étude elliptique avec deux clients, un à chaque extrémité, comme vos cibles, et où vous avez un territoire entre les deux sur lequel vous pouvez travailler, de façon idéale, du point de vue de l'ingénieur, vous allez tracer une ligne droite entre les deux.

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Harry m'a demandé de passer en revue l'atelier et d'en faire le résumé. Nous venons juste d'entendre les exposés, et nous allons également obtenir le compte rendu; il serait donc ennuyeux à l'extrême que je fasse un compte rendu détaillé de tout ce que j'ai entendu au cours de l'atelier. D'ailleurs, mon compte rendu ne serait probablement pas tout à fait exact parce que, comme Harry l'a mentionné, la classification écologique du territoire est un sujet qui me préoccupe indirectement bien que je m'occupe de travaux d'inventaire du territoire depuis longtemps. Je me souviens, vers 1965, avoir participé à un atelier avec des biologistes de la faune du Québec et des provinces de l'Atlantique pour examiner la façon dont nous allions catégoriser l'habitat de l'orignal pour l'Inventaire des terres du Canada. J'avais alors beaucoup d'expérience dans le travail d'inventaire du bois, en tant que forestier, et il s'agissait là d'un problème dont j'étais en mesure de m'occuper. Par conséquent, j'ai continué de m'intéresser à la CET par la suite. Mon amitié avec Will Holland, qui remonte à cette époque, a soutenu mon intérêt à cet égard.

Selon moi, le mieux à faire consiste à souligner certaines remarques que j'ai entendues ou certains sujets qui me semblent importants et qui ont été traités par diverses personnes au cours de l'atelier, et de m'étendre sur ces questions. Je n'ai pas de solution à proposer mais je pourrais peut-être aider à faire le point sur certains des problèmes et des préoccupations ainsi qu'à préciser la place qu'occupe la CET dans le cadre de nos activités de gestion de la faune. Bien entendu, la gestion de la faune est une composante de la gestion des ressources naturelles en général.

Dave Neave a mentionné que la clé de la protection des ressources fauniques est la protection des habitats. C'est là un énoncé que tous ceux qui travaillent dans le domaine de la biologie de la faune affectionnent tout particulièrement, et je crois qu'il est fondamentalement vrai. Cependant, selon moi, nous devons faire attention de ne pas exclure ou de ne pas négliger d'autres facteurs qui sont également importants. L'idée selon laquelle l'habitat est l'élément fondamental d'importance critique pour le maintien et l'amélioration des populations fauniques est, selon moi, prise en compte dans le cadre de la gestion faunique scientifique depuis les débuts, soit depuis près de 50 ans. Cette idée prend son origine dans les travaux de Aldo Leopold qui, en fait, était un forestier et qui tenait toujours compte des terres et de la végétation - cadre dans lequel ont lieu les augmentations et les diminutions des populations fauniques. Aldo Leopold a acquis une bonne partie de son expérience sur le terrain au Nouveau-Mexique et au Wisconsin où les extrêmes climatiques sont considérablement moindres qu'au Canada. À mesure que les extrêmes climatiques s'accentuent, ce facteur acquiert peut-être graduellement de l'importance. Nous savons tous que, pour survivre, une espèce faunique a besoin d'un habitat. Si nous éliminions progressivement les aéroports, à un moment donné il n'y aurait plus beaucoup d'avions à réaction dans les airs! Toutefois, lorsque le climat est aussi rigoureux qu'il l'est dans le Nord ou même ici, dans le sud de l'Alberta, quelle importance devrions-nous accorder à l'habitat? Dans quelle mesure la perte des habitats peut limiter la reproduction faunique? Je crois que nous devons nous interroger sur l'utilité et le potentiel de l'amélioration des habitats dans ces types d'environnement comparativement à d'autres activités de gestion. Nous devrions nous concentrer, dans une certaine mesure, sur cet élément fondamental de l'ensemble de nos activités. Il nous faut prendre en compte l'importance des habitats et faire de même dans nos recherches.

Un autre point qui m'a frappé lorsque je discutais avec les participants et au cours des séances d'affichage, c'est que nous ne savons pas vraiment en quoi consiste la classification écologique du territoire. Il semble que nous ayons diverses opinions à ce sujet, et c'est là un bon point. Ma propre ignorance me préoccupe mais je m'inquiète également du fait que nous ayons à nous occuper d'un sujet très complexe. Un large éventail d'opinions seront exposées et de nombreuses démarches seront

suggérées. Parfait. Cela signifie que nous pouvons progresser! Toutefois, je pense qu'il règne une certaine confusion quant à la CET. Cela découle de la confusion concernant les activités d'inventaire et les activités scientifiques, ainsi que la façon dont l'inventaire est lié au progrès en sciences et en gestion. Je pense que cet aspect est suffisamment important pour que l'on s'y attarde un peu.

Supposons que nous faisons face à une situation inconnue. Nous voulons, grâce au processus de découverte, passer de l'inconnu à une situation que j'ai appelée "plus ou moins connue" (fig 1). Le processus de découverte comporte un certain nombre d'étapes. Tout d'abord, nous éprouvons une certaine confusion face à la situation, nous en faisons donc l'inventaire pour savoir ce qu'il en est. La prochaine étape est l'analyse des résultats de l'inventaire. Alors, nous sommes en mesure de faire d'autres découvertes en perfectionnant notre démarche. Nous pouvons nous concentrer sur le problème et faire des expériences, ce qui, bien entendu, est la démarche classique en sciences. Si nous décomposons ces fonctions, la première étape d'un inventaire consiste à le concevoir. Ensuite, nous devons rassembler des données et les résumer. Le produit se présente sous forme de rapports, de tableaux ou de cartes. Puis nous analysons la situation, principalement à l'aide de la corrélation, technique très populaire en sciences, et au moyen de diverses autres méthodes statistiques. Nous essayons d'établir des liens entre les caractéristiques inventoriées pour voir si nous pouvons mieux comprendre les causes des variations.

Cela étant fait, nous sommes en mesure d'énoncer une hypothèse sur les relations entre certains des éléments. L'hypothèse, en général, prend la forme d'une prévision. Nous pouvons la mettre à l'essai soit dans le cadre de recherches fortuites soit dans le cadre de situations expérimentales que nous créons. Grâce aux essais effectués, nous serons en mesure de prévoir les résultats de nos actions. C'est ce qui se passe en sciences et, selon moi, il en est de même en gestion. Lorsque nous planifions l'utilisation d'une parcelle de terre, nous disposons d'un certain nombre de possibilités quant à la collecte des données sur différents paramètres. Il y a la démarche thématique habituelle comprenant les cartes des sols, les inventaires des forêts, les communautés végétales, les populations animales, etc. Les discussions du dernier groupe de travail au cours desquelles on a formulé des remarques sur la démarche thématique m'ont beaucoup intéressé. Il est possible, par l'analyse, de produire une série de cartes ou d'autres genres de documents mais, fondamentalement, dans le cadre de l'inventaire des terres, nous utilisons des cartes. Nous obtenons donc des cartes dérivées des analyses. Si nous allons sur le terrain, et c'est ce qui a été fait à Banff et à Jasper, et si nous faisons un inventaire suivant la méthode de la CET, nous combinons les étapes et nous obtenons une sorte de corrélation; toutes les données se trouvent sur la carte et la légende est complexe. Essentiellement, nous supposons que les animaux se trouveront dans certains paysages, que certains polygones regrouperont différentes populations animales, par exemple.

J'aimerais préciser qu'une prescription ou plan de gestion est la même chose qu'une hypothèse scientifique et qu'il peut être mis à l'essai au cours de la mise en oeuvre sur le terrain d'un plan de mise en valeur des habitats, de protection des habitats, etc. Il est alors possible de surveiller les résultats du plan. La surveillance est l'élément clé. Malheureusement, beaucoup de gestionnaires ne veulent pas savoir que leurs hypothèses sont fausses. Cela pourra être embarrassant! Si vous surveillez la mise en oeuvre de vos prescriptions, vous constaterez que vous pouvez perfectionner vos méthodes de gestion tout comme un scientifique perfectionne ses hypothèses, tout comme un chimiste dans son laboratoire, revenant toujours à son hypothèse en tenant compte des éléments dont il dispose, etc. Voilà, selon moi, un processus tout aussi respectable, au plan intellectuel, que tout autre processus de découverte scientifique et je pense que les gestionnaires utilisent ce processus chaque jour!

J'ai précisé la façon dont les inventaires s'insèrent dans le processus (fig. 1). Il serait peut-être intéressant d'examiner de quelle façon certains autres travaux que nous considérons comme scientifiques peuvent également s'y insérer. Par exemple, un article moyen dans un magazine populaire d'histoire naturelle entrerait dans la catégorie des inventaires. Quelqu'un est allé sur le terrain et a trouvé un nid d'une espèce d'oiseau qui n'avait jamais été observé dans le secteur et a rédigé un compte rendu comme s'il s'agissait d'une donnée d'inventaire. Si vous regardez dans une revue scientifique comme le Journal of Wildlife Management, une grande partie des articles comprennent l'inventaire et l'analyse de plusieurs paramètres (fig. 1), un peu comme un document de la CET. Dans certains articles, l'auteur ira plus loin et formulera une hypothèse. Cette étape est plus respectable au plan scientifique. En gestion, la production d'un plan d'aménagement est comparable à

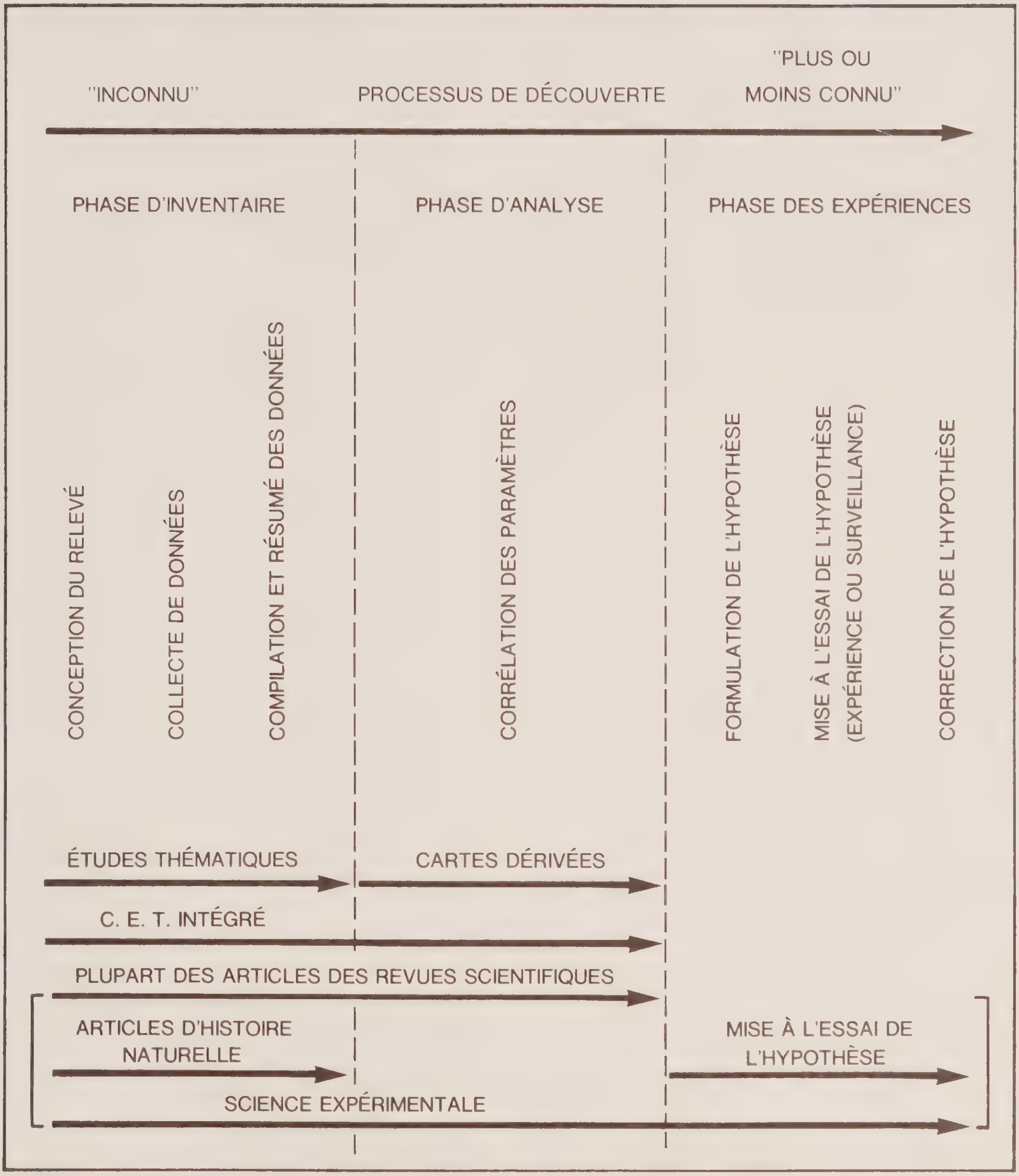

Figure 1 . Diagramme illustrant le processus d'examen rationnel des problèmes de science naturelle illustrant les relations proposées entre les inventaires et les expériences .

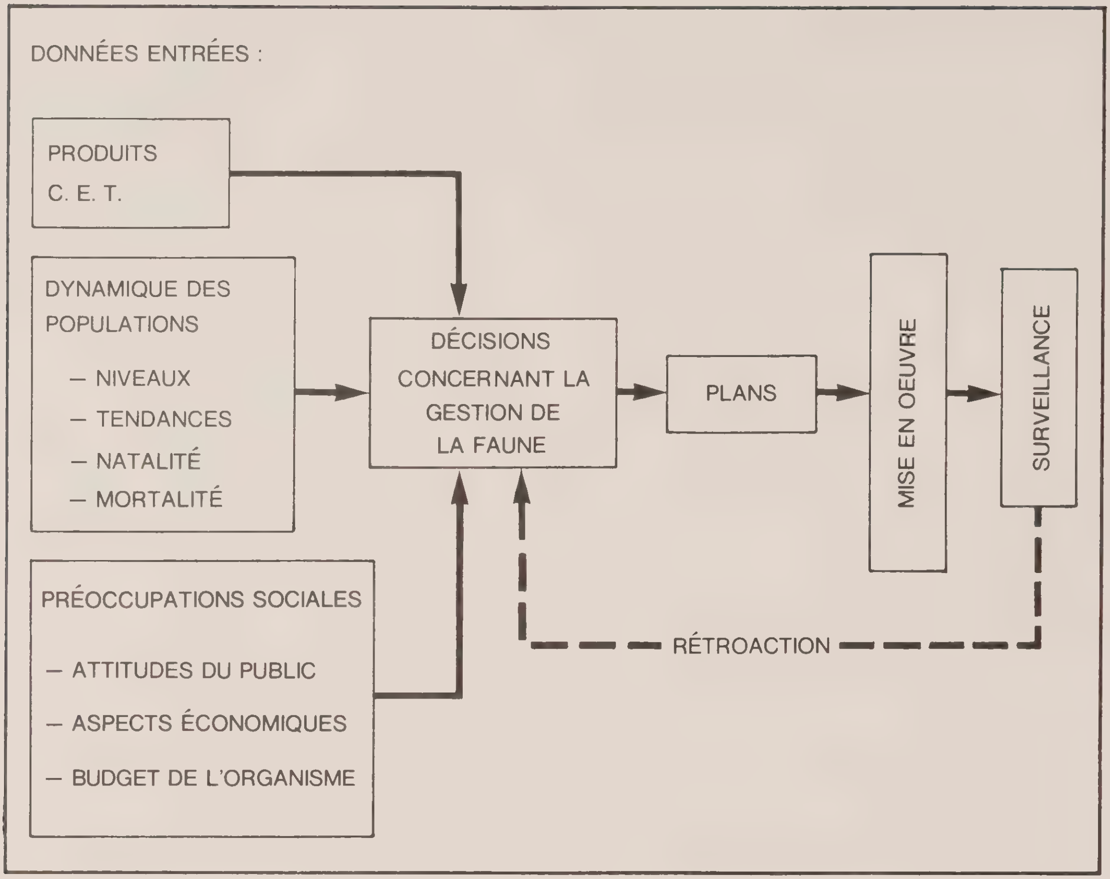

Figure 2 . Diagramme illustrant le processus décisionnel en matière de gestion de la faune

cette étape. Bien entendu, un travail scientifique de qualité et complet débute par un inventaire et suit tout le processus y compris la formulation de l'hypothèse, la mise à l'essai, la surveillance, la rétroaction pour la reformulation de l'hypothèse, etc. Il est également possible de partir avec une hypothèse formulée par quelqu'un d'autre.

Lorsque nous faisons des inventaires et que nous énonçons des hypothèses sous forme de plans de gestion, nous envisageons le processus de gestion de la faune comme un ensemble et nous voyons où s'insère la CET. À la figure 2, j'ai esquissé le processus décisionnel en matière de gestion de la faune. Quelqu'un, soit une équipe de planification soit un administrateur, doit prendre les décisions. Si une équipe de planification prend les décisions, alors l'administrateur lui donne habituellement son aval. Les produits de la CET sont l'un des points à prendre en considération. Il nous faut connaître ce à quoi nous avons affaire avant de prendre une décision sur la façon de régler le problème. Toutefois, il existe un grand nombre d'autres facteurs en plus des données de la CET. S'il s'agit d'une décision concernant la faune, il faut prendre en considération la dynamique des populations de l'espèce visée. Quel est le nombre d'individus actuellement? Quel était-il l'an dernier? Il y a cinq ans? Quelle est la tendance? Est-elle à la hausse ou à la baisse? Quels sont les facteurs de natalité? Combien d'animaux s'ajoutent chaque année à la population? Qu'en est-il de la mortalité? Combien d'individus sont tués par des chasseurs? Combien d'individus constituent la proie des loups ou meurent à cause des polluants, dans le cas du poisson? Il s'agit là de données d'histoire naturelle, mais les préoccupations sociales sont également importantes, comme l'a mentionné le dernier groupe de travail dans son compte rendu. Est-ce que le public se préoccupe du nombre d'individus de l'espèce visée ou est-ce qu'il s'en fiche? L'espèce est-elle importante pour les scientifiques mais non pour les chasseurs ou vice-versa? Quels sont les aspects économiques de la situation? Faut-il mettre un frein au développement économique local en vue de protéger certaines espèces? Alors, bien entendu, surgit le problème du budget. De toute évidence, il est impossible de mettre en oeuvre un programme important de restauration ou d'achat des habitats, par exemple, si l'on ne dispose pas d'un budget suffisant. Tous ces points doivent être pris en considération lorsque l'on prend des décisions quant à la gestion.

Lorsqu'une décision est prise, il s'agit essentiellement d'une hypothèse, comme nous l'avons vu à la figure 1. Par exemple, la décision de préserver l'habitat riverain suffira au maintien d'une espèce aviaire particulière. Le plan est élaboré et, espérons-le, est mis en oeuvre; le secteur et l'habitat voulus sont protégés. Idéalement, un programme de surveillance sera réalisé pour voir si le plan atteint le but visé. Peut-être, au bout de cinq ans, nous constaterons une augmentation de seulement 10 % de la population de l'espèce visée par rapport à ce qu'elle était au début de la période de réalisation du plan. Il n'est pas rare que de telles choses se produisent! Toutefois, les prescriptions gestionnelles sont peut-être une réussite, les tendances et le nombre d'individus se maintiennent. Le gestionnaire est libre de changer son plan ou de décider qu'il est sur la bonne voie. Par ailleurs, il est possible que le public réagisse assez violemment et exige la prise de mesures additionnelles pour la protection de l'habitat du cerf, par exemple. On se rendra peut-être compte que les produits de la CET ne comprennent pas certains paramètres clés et qu'il faut aller sur le terrain pour recueillir d'autres données. Selon moi, nous devons nous rendre compte que, dans le cadre de ce processus, les produits de la CET sont importants, mais ne constituent qu'un élément pour la prise de décisions quant à la gestion. Dave Neave et Ron Jakimchuk ont souligné le fait que beaucoup d'autres éléments doivent être pris en considération.

Les méthodes que nous allons utiliser pour faire accepter les produits de la CET me préoccupent, ainsi que le personnel qui a participé à l'inventaire de Banff et Jasper. Kurt Seel s'est arrêté sur cette question l'autre jour. Nous pouvons facilement remplir des bibliothèques entières avec des rapports que personne ne prend la peine de lire avant de prendre des décisions. La même chose est possible avec les produits de la CET. Les problèmes sont peut-être aussi grands dans le cas des banques de données informatisées dont l'accès requiert un certain nombre de connaissances technologiques. Combien de personnes qui pourraient avoir besoin des banques de données sont en mesure d'y accéder? Comment allons-nous faire pour s'assurer qu'elles y aient accès, qu'elles se rendent compte de l'importance de ce que nous faisons? Selon Kurt, il faut qu'un produit soit intéressant aux yeux de l'utilisateur pour que ce dernier l'accepte. On dit que lorsque vous utilisez une expression à plusieurs reprises, elle vous appartient; alors j'utiliserai moi aussi l'expression employée par Kurt!

Il existe un mur entre les produits de la CET et les rapports achevés et leur mise en oeuvre. Lorsqu'un organisme de gestion finance une étude importante, il en résulte un produit, voilà tout. L'expert-conseil ou l'employé qui a effectué le travail s'en acquitte. Il a compilé les résultats. Peut-être a-t-il analysé les données et effectué du bon travail, mais il y a toujours un mur. D'une manière ou d'une autre, les résultats de la CET ne sont pas utilisés. Si nous consultons à nouveau la figure 1, nous constatons que, assez souvent, le mur se trouve entre l'étape de l'analyse et l'étape de la prévision et de l'élaboration de l'hypothèse. Nous effectuons un inventaire et une analyse et nous communiquons les résultats au gestionnaire. Ou il n'a pas les connaissances nécessaires pour évaluer le matériel et, par conséquent, énonce une hypothèse médiocre sur la façon dont les résultats s'appliquent à la gestion ou encore il est tout simplement trop occupé. Il aimerait faire du bon travail mais il n'a tout simplement pas le temps, alors il parcourt rapidement le rapport et propose quelque chose qui peut n'avoir aucun rapport avec le matériel fourni. D'autres raisons expliquent l'existence d'un mur. Il peut y avoir eu manque de communication au sujet de "l'inconnu" initial. La conception de l'inventaire était peut-être erronée et les paramètres étudiés n'étaient pas pertinents. Il en est résulté un ensemble de données sans aucun rapport avec le problème ou concentrées en partie seulement sur celui-ci.

Pour revenir à un autre problème dont nous devons vraiment nous inquiéter relativement au relevé biophysique de Banff et de Jasper, les résultats de l'inventaire et de l'analyse peuvent être inaccessibles parce que nous les avons emmagasinés dans un système informatisé. Est-ce que les personnes qui ont réellement besoin des informations sont en mesure d'y accéder? Heureusement, cet aspect posera de moins en moins de problèmes à l'avenir étant donné que, de nos jours, on enseigne l'informatique dès le secondaire. Cependant, pour le moment, le problème existe et il continuera d'exister pendant un certain nombre d'années. En fait, l'utilisation des ordinateurs causera probablement toujours certains problèmes de communication mais un jour, le problème deviendra aussi bénin que celui dont Kurt parlait, c'est-à-dire des bibliothèques pleines de rapports volumineux que les gestionnaires affairés ne lisent pas, faute de temps.

Pour résumer toutes ces remarques au sujet de l'acceptation du produit, nous devons nous rappeler que la CET est un phénomène complexe. Il est difficile de vulgariser ce processus. Avez-vous déjà essayé d'expliquer à quelqu'un n'ayant aucune connaissance sur les ressources naturelles ce que nous essayons de faire? Un de mes amis bien au fait des questions relatives à l'inventaire des terres a décidé de rédiger un article pour un magazine populaire d'histoire naturelle en vue d'expliquer le processus de la CET. Il a rédigé une courte ébauche mais celle-ci n'a pas eu beaucoup de succès auprès du directeur du magazine. Je crois que cela montre bien la difficulté d'expliquer au public ce processus complexe comportant de nombreux paramètres et diverses cartes. Avec les gestionnaires et les administrateurs, il nous faut vraiment simplifier les choses. Il est difficile de faire accepter le produit, et nous devons nous concentrer sur cet aspect à toutes les étapes.

Le dernier point que j'aimerais souligner porte sur ce qu'a dit Ron Jakimchuk au sujet de l'importance de la recherche sur les relations entre les caractéristiques des habitats. Pourquoi les animaux utilisent-ils certaines caractéristiques? Quel est notre potentiel en matière de prévision? Après cinquante années de recherches sur le cerf de Virginie, l'orignal et le wapiti, nous ne sommes pas encore parfaitement en mesure de prévoir où ils se trouveront, pourquoi ils occuperont certains endroits et à quel moment ils s'y trouveront. Lorsqu'il s'agit de l'ensemble des oiseaux non considérés comme gibier et des autres espèces fauniques, nos connaissances sont réellement limitées quant aux raisons de leur présence à certains endroits et, en fait, notre capacité à décrire leurs habitats est également limitée. Comment voient-ils le monde? Pouvons-nous acquérir des connaissances à cet égard? Parmi les autres problèmes graves que nous avons rencontrés au cours de nos travaux à Banff et à Jasper, citons l'intégration des facteurs aquatiques au cadre de la CET. Et même, devrions-nous essayer d'intégrer ces facteurs? Des recherches considérables sont nécessaires sur tous ces points. Je ne parle pas d'études orientées vers la gestion, mais d'études scientifiques qui, en fait, peuvent entraîner la production de rapports volumineux. Il est à espérer que ces rapports porteront sur des sujets particuliers et contiendront des résultats permettant d'accroître nos connaissances sur les relations entre les animaux et les habitats. J'ai pensé qu'il ne plairait pas aux personnes qui s'occupent beaucoup de recherche que je passe sous silence cet élément.

Questions posées à Ed Telfer

Geoff Holroyd: Simplement une remarque, je ne veux pas défier Ed. Je tiens à le remercier de m'avoir mieux fait voir ce que nous faisons, et d'après moi, un grand nombre de remarques formulées au cours des trois derniers jours s'insèrent dans la figure 1. J'aimerais souligner deux points. Premièrement, la méthode de la CET, comme indiquée, nous permet de surmonter la difficile phase de la corrélation. Je sais que c'est cette phase qui pose des problèmes à Kurt. En 1977, il nous a fait prendre conscience de cet aspect; c'est à cette étape que les inventaires thématiques prennent fin, avec la phase d'inventaire, et nous donnons les résultats à quelqu'un qui est censé les utiliser mais qui ne peut établir la corrélation et donc, ne peut franchir cette étape. Donc, dans le cadre de la CET, nous poussons peut-être le brouillard vers la droite sur la figure 1, mais nous sommes encore dans le brouillard à cette étape. Je ne vais pas vous indiquer un chemin à travers ce brouillard, mais je pense que certains d'entre nous sautent l'étape de la corrélation et entrent dans le brouillard à l'étape suivante. Nous sautons par-dessus la phase d'analyse, au milieu de la figure 1. Nous essayons de formuler l'hypothèse et de la mettre à l'essai sans faire tout d'abord la corrélation, et je pense qu'il s'agit là de deux poches de brouillard que nous pouvons traverser. Il y a encore une troisième poche de brouillard à la fin du processus de la CET et à la fin de la phase d'analyse (figure 1); je ne suis pas sûr de savoir comment faire pour la traverser mais je pense que nous nous préparons à le faire.

Ed Telfer: Merci Geoff. Je pensais que vous alliez peut-être dire amen à mes remarques sur la nécessité de faire preuve de simplicité dans les négociations avec les gestionnaires!

Herb Goulden: Harry a parlé des différents participants à l'atelier, il m'a regardé et il a dit qu'il était heureux que de vieux routiers prennent part aux travaux. Je voulais souligner deux points, et Ed est tombé en plein dessus. Premièrement, il nous faut faire accepter notre technologie; je ne suis pas ici en tant que technologiste mais en tant que "vendeur". Mon directeur m'a envoyé ici surtout pour essayer de comprendre ce qui se fait dans le cadre de la CET pour que je lui en rende compte et qu'il puisse discuter de la chose avec le ministre de façon à ce que nous obtenions les fonds nécessaires. Nous convenons tous que nous avons les instruments nécessaires à notre portée mais que nous ne pourrons jamais les utiliser si nous ne pouvons faire accepter l'idée du processus dans son ensemble. Pour ce faire, il nous faudra éviter d'utiliser un langage obscur. Je vais vous lire un exemple: "Objectif numéro deux, déterminer les avantages et les inconvénients d'une méthode écologique intégrée d'inventaire des habitats y compris la détermination des méthodes, produits et présentations appropriés et inappropriés". Bien, je ne comprends pas ce que cela signifie. J'ai eu la bonne fortune de m'occuper de ce domaine il y a une dizaine d'années, lorsque nous utilisions l'expression inventaire biophysique. Personne non plus ne comprenait alors ce que nous faisions! Je crois que nous devons nous efforcer de parler un langage simple que les ministres comprennent parce que ce sont eux qui nous donnent les crédits nécessaires à nos activités.

Vous savez que les temps étaient moins durs au cours des années 70 et que les relations entre lès gouvernements fédéral et provinciaux étaient moins tendues; chacun assumait la moitié des coûts et nous avions des crédits pour faire beaucoup de travail. Si vous écoutez maintenant ce que disent Pierre Trudeau et l'ancien premier-ministre Stirling Lyon, vous savez que ces temps sont révolus et que les crédits ne sont plus aussi libéralement accordés soit par le gouvernement fédéral, soit par les administrations provinciales. En tant que fonctionnaire provincial du Manitoba, je peux dire que si nous voulons effectuer ce genre de travail à l'échelon provincial, il faut que les fonds proviennent des coffres de la province, même si, je dois le dire, je suis ici grâce, en partie, au gouvernement fédéral. Maintenant, je suis peut-être en mesure de convaincre le premier ministre du Manitoba, mon ministre et mon directeur de l'utilité de la CET pour la prise de décisions concernant l'utilisation des ressources. Merci Ed. Vous avez fait un excellent travail.

APPENDIX

APPENDICE

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